

MULTI-HAZARD MITIGATION PLAN

Prepared for:

**Marion County, Indiana
City of Indianapolis, Indiana
City of Beech Grove, Indiana
City of Lawrence, Indiana
Town of Speedway, Indiana
City of Southport, Indiana**

March 2006

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CBBEL Project Number 04-185A

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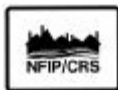
1.0**INTRODUCTION****1.1 PROJECT SCOPE AND PURPOSE**

The development of a Multi-Hazard Mitigation Plan (MHMP) is a requirement of the Federal Disaster Mitigation Act of 2000 (DMA 2000). According to DMA 2000, the purpose of mitigation planning is for State, local, and Indian tribal governments to identify the natural hazards that impact them, to identify actions and activities to reduce any losses from those hazards, and to establish a coordinated process to implement the plan, taking advantage of a wide range of resources.

In order for National Flood Insurance Program (NFIP) communities to be eligible for future mitigation funds, they must adopt either their own MHMP or participate in the development of a multi-jurisdictional MHMP. The Indiana Department of Homeland Security (IDHS) and the Federal Emergency Management Agency (FEMA) Region V offices administer the MHMP program in Indiana.

The Marion County MHMP is a unique multi-jurisdictional planning effort led by the Marion County Emergency Management Department (EMD). This Plan is inclusive of all jurisdictions within Marion County and was prepared in partnership with the City of Indianapolis, City of Beech Grove, City of Lawrence, City of Southport, and the Town of Speedway. Representatives from each of these communities attended Planning Committee meetings, provided valuable information about their community, reviewed and commented on the draft MHMP, and assisted with local adoption of the approved Plan. Since each of the communities participating had an equal opportunity for participation and full representation in the planning process, the process used to develop the Marion County MHMP satisfies the requirements of DMA 2000 in which multi-jurisdictional plans may be accepted, as appropriate, as long as each jurisdiction has participated in the planning process.

The development of this MHMP is the necessary first step of a multi-step process to implement programs, policies, and projects to mitigate the effect of hazards in Marion County. The intent of this planning effort was to identify the hazards and the extent that they affect Marion County, and to formulate mitigation strategies or projects that could be undertaken to mitigate for these hazards. Although this MHMP meets the requirements of DMA 2000 and eligibility requirements of the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA), Pre-Disaster Mitigation (PDM) Grant, as well as other FEMA programs including the NFIP Community Ratings System (CRS), additional detailed studies will need to be completed prior to applying for these grants or programs.



Throughout this Plan, activities that could count toward CRS points are identified with the NFIP/CRS logo. The CRS is a voluntary incentive program that recognizes and encourages community floodplain activities that exceed the minimum NFIP requirements. As a result, flood insurance premiums rates are discounted to reflect the reduced flood risk resulting from community actions that meet the three goals of the CRS: (1) reduce flood losses; (2) facilitate accurate insurance rating; and (3) promote education and awareness of flood insurance. Savings in flood insurance premiums are proportional to the points assigned to various activities. A minimum of 500 points are necessary to enter the CRS program and receive a 5% flood insurance premium discount. This Plan could contribute as many as 294 points toward participation in the CRS. At this time, there are no CRS eligible communities in Marion County.

Funding to prepare this MHMP was made available through a Pre-Disaster Mitigation Planning (PDM) grant that the IDHS awarded to the Marion County EMD. Christopher B. Burke Engineering, Ltd. (CBBEL) was hired to facilitate the planning process and prepare the Marion County MHMP.

1.2 PLANNING PROCESS

Preparation for the Marion County MHMP began January 2004 when the Marion County EMD Coordinator and City of Indianapolis Division of Compliance Assistant Administrator requested funds from IDHS to prepare a MHMP for the County and NFIP communities. Once those funds were approved in April 2004, the City of Indianapolis hired CBBEL in May 2005.

In order to comply with the requirements of DMA 2000 and be eligible for mitigation project grants, the planning process to prepare the Marion County MHMP was on an accelerated timeline. In July 2005, the EMD Coordinator compiled a list of Planning Committee members that would meet once a month in August, September, October, and December. From August 2005 through December 2005, CBBEL researched and compiled historic hazard data necessary to prepare the MHMP. In February 2006, CBBEL provided the draft Marion County MHMP to the Planning Committee for their review and comment. A public meeting was scheduled in February 2006 to present the draft Plan to the public and other interested parties. Public comments were accepted through the end of February 2006 and then the Plan was forwarded to IDHS and FEMA for their review and comment. Comments from IDHS and FEMA were incorporated into the draft Plan and reviewed by the Planning Committee. Local adoption of the Marion County MHMP was complete in July 2006.

1.3 PLANNING COMMITTEE

The Marion County MHMP Planning Committee was a new committee specifically formed to develop this Plan. Members included representatives from Marion County, the City of Indianapolis, City of Beech Grove, City of Lawrence, Town of Speedway, and City of Southport that were knowledgeable of local hazards; been involved in hazard mitigation; and/or had the tools necessary to reduce the impact of future hazard events. The 30-member Planning Committee included representatives from engineering, emergency management, public information, public safety, public works, planning, zoning and code enforcement, parks and recreation, and public utilities. **Table 1-1** lists the individuals that participated on the Planning Committee and the entity they represented.

The Planning Committee met on August 31, September 26, October 24, and December 5, 2005. These meetings were held at the Emergency Operation Center (EOC) and the City of Indianapolis' Sherman Avenue Office. Committee meetings were well attended by representatives from each NFIP community. The Planning Committee discussed and made decisions on the development of the Plan based on information presented at each meeting. During these meetings, the Planning Committee identified critical facilities and local hazards; reviewed the State's mitigation goals and set local mitigation goals; reviewed hazard data and maps; identified and assessed the effectiveness of existing mitigation measures; established mitigation projects; and reviewed materials for public participation. A sign-in sheet recorded those present at each meeting to document participation. Meeting agendas and summaries are included in **Appendix 2**.

Table 1-1: MHMP Planning Committee

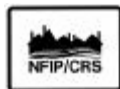
Name	Title	Representing
John Ball	Major	IPD – Emergency Preparedness
Tom Bassett	GIS Analyst	DMD – Compliance
Shane Booker	Coordinator	Indy Parks – Risk Management
Gregg Bowes	Councilor	City-County Council
Dennis Buckley	Chief	Beech Grove Fire Department
Steve Campbell	Deputy Mayor	Office of the Mayor – Indianapolis
Randal Collins	Coordinator	EMD
Glenn Curtis	Assistant Chief	Speedway Fire Department
Jerome Harrington	Director	ARC – Emergency Services
Gregg Harris	Public Information Officer	IFD
Tim Hayes	Senior Planner	DMD – Subarea Planning
Adam Holman	Building Code Analyst	DMD – Compliance
Gary Huddleston	Senior Planner	DPW – Planning
Jeff Larmore	Manager	MCHD – Hazardous Materials
Fred Laughlin	Director	IDI – Management Services
Ron Lauster	Director	SWCD
Bob Merriman	Principal Planner	DMD – Current Planning
Phyliss Peden	Coordinator	MCHD – Emergency Preparedness
Dennis Peters	Liaison	IPD – Emergency Preparedness
Donna Price	Assistant Administrator	DMD – Compliance
Steve Pruitt	Assistant Administrator	DPW – Maintenance Operations
Ray Raney	Director	MECA – Communications
Phil Reuter	Captain	IFD – Hazardous Materials
Dennis Slaughter	Senior Planner	DMD – Planning
Dale True	Lieutenant	IPD – Emergency Management
Jim White	Director	EMD
Tom White	Senior Project Manager	Department of Public Works
Gary Woodruff	Detective	Lawrence Police Department
Layne Young	Manager	Indianapolis GIS – Business Relationship

1.4 PUBLIC INVOLVEMENT IN THE PLANNING PROCESS

[Public meeting tentatively scheduled for March 2006. Once complete, insert information on public meeting attendance, discussion and outcome. Include the media release for the public meeting in **Appendix 3.**]

1.5 INVOLVEMENT OF OTHER INTERESTED PARTIES

Neighboring EMA Directors in Boone, Hamilton, Hancock, Shelby, Johnson, Morgan and Hendricks Counties, as well as interested agencies, businesses, academia, and nonprofits were invited to review and comment on the draft Marion County MHMP.



The CRS program credits NFIP communities a maximum of 100 points for organizing a planning committee composed of staff from various departments; involving the public in the planning process; and coordinating among other agencies and departments to resolve common problems relating to flooding and other known natural hazards.

2.0**COMMUNITY INFORMATION**

The City of Indianapolis, City of Beech Grove, City of Lawrence, City of Southport, and the Town of Speedway are located within Marion County, Indiana. Marion County is a large predominately urban county located in Central Indiana. As of the 2000 census, Marion County was by far the most populace county in the State with a population of 860,000. In addition, the Indianapolis Urbanized Area, which encompasses portions of Marion, Boone, Hamilton, Madison, Hancock, Shelby, Johnson, Morgan, and Hendricks Counties, is the largest metropolitan area in the state with a combined population of approximately 1.6 million people.

In 1970, the City of Indianapolis expanded its boundaries to include all of Marion County. This consolidation was called the unified government of Uni-Gov. Many units of City and County government were consolidated into one civil government, including the City Council and the County Council, which joined to become the City-County Council.

There were 16 towns in Marion County with fewer than 5,000 people that elected to retain town status as defined by the state constitution. They are, however, included for governmental purposes in the Consolidated City of Indianapolis. The Cities of Beech Grove, Lawrence, and Southport and the Town of Speedway were not annexed into the Consolidated City of Indianapolis. These municipalities are called excluded cities and towns. In addition to voting for the mayors and councils of their respective cities and towns, residents can also vote for the Mayor of Indianapolis plus a City-County Council member and four at-large council members. Even with Uni-Gov however, the Cities of Beech Grove, Lawrence, and Southport and the Town of Speedway depend on the City of Indianapolis and Marion County to provide some essential services to their community.

2.1 NATIONAL FLOOD INSURANCE PROGRAM (NFIP) PARTICIPATION

The City of Indianapolis (Marion County), City of Beech Grove, City of Lawrence, City of Southport, and Town of Speedway are all members of the National Flood Insurance Program (NFIP). Although each community has their own NFIP number, as shown in **Table 2-1**, all communities jointly participate in the NFIP under one coordinator. The City of Indianapolis NFIP Coordinator represents the interests of all the NFIP communities in Marion County. At the time of preparing this MHMP, none of the NFIP communities participates in the Community Ratings System (CRS) program.

Table 2-1: NFIP Participation

	NFIP Number	Join Date	CRS Effective Date
City of Indianapolis (Marion County)	180159	5/15/1984	NA
City of Beech Grove	180158	5/15/1984	NA
City of Lawrence	180160	5/15/1984	NA
City of Southport	180161	5/15/1984	NA
Town of Speedway	180162	5/15/1984	NA

(FEMA, 2005)

2.2 POPULATION & DEMOGRAPHICS

Overall, Marion County is experiencing average growth for Indiana, and ranked 44th among 92 counties with a growth rate of 7.9% between 1990 and 2000. The 2004 population of Marion County was 863,596, and the County's population is projected to expand to 866,409 by 2010. The largest municipality in Marion County is the City of Indianapolis, which encompasses all of Marion County with the exception of excluded cities and towns.

According to 2003 data, the median age of the population of Marion County is 34.6 years. The largest demographic age groups in the County is young adults (25–44 years), which account for approximately 30.9% of the population, older adults (45–64 years), which account for 22.6% of the population, and school age children (5–17 years), which account for approximately 18.7% of the population. The ethnic majority in the County is white, comprising approximately 71.0% of the County population. Black is the next largest ethnic group in the County, comprising approximately 25.6% of the population. Approximately 18.4% of the population in Marion County is married with children and 54.0% of homes are owner occupied.

2.3 HOUSING & COMMUNITY DEVELOPMENT

According to the Marion County Comprehensive Plan, the population of Marion County increased by 8.4% between 1970 and 2000. However, the number of households in the County increased by 10.1% from 319,821 to 352,164 over the same period. The accelerated growth of households over population is associated with the “baby boom” generation moving out of their parent's homes, increased divorce rates, and an increased propensity of Americans to live alone. In addition, while the Marion County population grew by 7.9% from 1990 to 2000, the number of developed acres in the County increased by 43%. However, despite this growth, Marion County's proportion of the Indianapolis Metropolitan Area's total population has decreased from 63.4% in 1970 to 53.5% in 2000. Considering the lack of developable land remaining in the Marion County, it seems likely that future growth in the Indianapolis Metropolitan Area will be heaviest in surrounding counties.

2.4 LAND USE & DEVELOPMENT TRENDS

According to a year 2000 study conducted by Indiana University – Purdue University Indianapolis (IUPUI), the most common land use classifications in Marion County are low and high-density development and grasses, which collectively cover roughly 73% of the County. Agricultural lands are the next most common land use, accounting for approximately 11% of County land uses. Forests account for approximately 8% of County land uses, while major roads account for approximately 2% of land uses. The remaining land uses include open water, wetlands, and gravel pits. **Table 2-2** displays the distribution of land-use types within Marion County.

Table 2-2: Land Use

Land Use Description	Marion County (Acres)	Percent of County
High Density Development	36,618	14
Low Density Development	81,362	32
Bare Soils/ Sparse Vegetation	3,056	1
Mines, Quarries, Gravel Pits	3,362	1
Forest	21,773	8

Land Use Description	Marion County (Acres)	Percent of County
Grasses	69,014	27
Agriculture	28,591	11
Wetland Forest	1,651	1
Wetland Woodlands	228	<1
Wetland Bare Soil	53	<1
Water	7,511	3
Major Roads	4,197	2
Totals	257,690	100

(IUPUI, 2000)

2.5 TRANSPORTATION AND COMMUNITY TRENDS

Overall, far more people are commuting into Marion County for work than are commuting from Marion County to outlying counties. 2003 estimates show that 190,500 people are commuting into Marion County on a daily basis, while only an estimated 32,000 people are commuting from Marion County to surrounding counties.

2.6 EMPLOYMENT AND INDUSTRY

Census data from 2003 shows that of the total working force in Marion County, 87.8% worked in the private sector, which includes retail trade, construction, professional technical services, and health care and social services. The County's annual per capita personal income in 2003 was \$33,449, the median household income in was \$41,416, the poverty rate was 12.5%, and there were 667,883 employed individuals.

According to the U.S. Bureau of Economic Analysis, the largest employment sectors for Marion County are government, manufacturing, health care and social services, retail trade, and accommodation/food service. These employment sectors employ approximately 80,800, 73,500, 72,900, 67,400, and 47,300 individuals, respectively.

2.7 CRITICAL AND NON-CRITICAL FACILITIES

Critical facilities are those that are vital to the health, safety, and welfare of the population. These facilities are vital to the community's ability to provide essential services and protect life and property, are critical to the community's response and recovery activities, and/or are the facilities the loss of which would have a severe economic or catastrophic impact. The operation of these facilities becomes especially important following a hazard event.

Critical Facilities can be considered within the following categories:

- **Governmental Facilities** – essential for the delivery of critical services and crisis management including data and communication centers and key government complexes
- **Essential Facilities** – vital to health and welfare of entire population including hospitals and other medical facilities, police and fire, emergency operations centers, evacuation shelters, and schools.
- **Transportation Systems** – necessary for transport of people and resources including airports, highways, railways, and waterways.

- **Lifeline Utility Systems** – vital to public health and safety including potable water, wastewater, oil, natural gas, electric power, and communication systems.
- **High Potential Loss Facilities** – failure or misoperation may have significant physical, social, and/or economic impact to neighboring community including nuclear power plants, high hazard dams, and military installations.
- **Hazardous Material Facilities** – involved in the production, storage, and/or transport of corrosives, explosives, flammable materials, radioactive materials, and toxins.

Marion County critical facilities were identified utilizing several available tools including, HAZUS-MH software, the Marion County EMD's critical infrastructure list, and input from the Planning Committee. Once this process was complete, 1,015 critical facilities were identified and mapped within Marion County.

These facilities include 10 Governmental Facilities, 517 Essential Facilities (387 schools, 3 emergency operation centers, 25 law enforcement facilities, 28 medical care facilities, 74 fire stations), 14 Transportation System Facilities (4 bus/train stations, 10 airports) 340 Lifeline Utility Systems (4 advanced wastewater treatment plants, 9 water treatment plants, 8 telecommunication facilities, 3 pumping stations, 17 lift stations, 23 gas and electric power facilities, 276 power substations), 23 High Potential Loss Facilities (18 dams, 5 military installations), and 111 Hazardous Materials Facilities. Due to their critical nature, these facilities should generally not be located in known hazard areas – especially the 500-year floodplain limits. While this may be unavoidable for some critical facilities such as wastewater treatment plants, lift stations, and pumping stations to be located in the floodplains, these and other facilities in known hazard areas need to be protected or relocated from the known hazard area when possible. **Exhibits 1A – 1F** show the general location of critical facilities in Marion County in relation to the known flood hazard areas (100-year and 500-year, when determined)

Of the total 1,015 critical facilities, 935 are located in the City of Indianapolis, 16 are located in the City of Beech Grove, 33 are located in the City of Lawrence, 5 are located in the City of Southport, and 26 are located in the Town of Speedway. **Appendix 4** lists all critical facilities by NFIP community as well as those identified on Exhibits 1A through 1F.

In addition to critical facilities, there are an estimated 323,711 non-critical facilities located in Marion County. The development of this MHMP focused on critical facilities; thus, non-critical facilities are not mapped or listed. However, there are approximately 292,213 residential structures, 20,355 commercial structures, 9,065 industrial structures, 257 government structures, 479 education structures, and 1,342 religious structures.

2.8 MAJOR WATERWAYS AND WATERSHEDS

Marion County is drained by numerous rivers, creeks, brooks, runs and ditches, all of which eventually flow into the White River (although Buck Creek takes a circuitous route via the Big Blue River). According to the Indiana Department of Natural Resources (IDNR) and the Indiana Department of Environmental Management (IDEM), there are 225 waterways in Marion County. West Fork White River, Fall Creek, and Eagle Creek are the three largest waterways in the County. The White River flows predominantly from north to south through the County and downtown Indianapolis. The two largest tributaries of the White River are Eagle Creek and Fall Creek. Eagle Creek flows from the north-west of the County, through the Town of Speedway, and then drains into the White River downstream of downtown Indianapolis. Fall Creek flows from the northeast, along the northern boundary of the City of Lawrence, and joins White River upstream of downtown Indianapolis. The Eagle Creek Dam, located in the northwest corner of

the County and Geist Reservoir, located on the northeast corner, regulate water levels for Eagle Creek and Fall Creek respectively.

According to United States Geological Survey (USGS), there are 41 14-digit Hydrologic Unit Code (HUC) watersheds in Marion County. The largest watershed is the Pleasant Run Creek – Buffalo Creek (15,111.2 acres) and the smallest is the Eagle Creek-Neeld Ditch/Blue Lake (3,377.8 acres). **Appendix 5** lists the 225 major waterways and all the 14-digit HUC watersheds in Marion County.

2.9 TOPOGRAPHY

Located in central Indiana, Marion County consists of approximately 258,000 acres and is located in the lower third of the Tipton Till Plain. The relief and soils of the region were influenced by three glacial periods. As the last of these glaciers retreated, the County was scoured to a relatively flat plain with a gently rolling surface, with elevations ranging from approximately 650 to 900 feet above sea level. The more distinctive slopes in the County have been formed by the actions of the numerous rivers, streams, and tributaries located in the County. In general, glacial deposits in the County range from 15 to 300 feet in thickness, and cover the County in clay rich alluvial soils. In addition to the glacial till, deposits of sand and gravel has occurred, especially in the White River, Buck Creek, Eagle Creek, and Fall Creek stream valleys.

2.10 CLIMATE

Climate data was retrieved from the Midwestern Regional Climate Center and includes information retrieved from weather stations in Marion County. The average annual temperature for Marion County is 52.6 °F. Average annual precipitation is 40.72" a year, with the wettest month being July (4.38" average), and the driest month being February (2.42" average). The highest recorded 1-day maximum precipitation event was 7.2" in September 2003. Average annual snowfall is 25.3" per year. The record monthly snowfall total occurred in January 1978, when 30.6" inches of snow fell to the ground. On average, there are 126.8 days of rain greater than or equal to 0.01", 27.5 days of rain greater than or equal to 0.5", and 9.6 days of rain greater than or equal to 1.0" of depth.

3.0 RISK ASSESSMENT

The goal of mitigation is to reduce the future impacts of a hazard including property damage, disruption to local and regional economies, and the amount of public and private funds spent to assist with recovery. To realize this goal, a comprehensive examination of natural hazard risk in a community is required. A risk assessment measures the potential loss from a hazard event by assessing the vulnerability of buildings, infrastructure, and people in a community. It identifies the characteristics and potential consequences of hazards, how much of the community will be affected by a hazard, and the impact on community assets. A risk assessment consists of three components: hazard identification, risk analysis (extent of hazard), and vulnerability analysis. Technically, these are three different items, but the terms are often used interchangeably.

3.1 HAZARD IDENTIFICATION

The MHMP Planning Committee reviewed the list of natural hazards prepared by FEMA, identified those hazards that affected Marion County, and agreed upon which hazards they would like to study in detail as part of this planning effort. In addition to the list of natural hazards provided by FEMA, the Planning Committee discussed the storage and transport of hazardous materials, conflagration/structural fire, utility failure, pandemic/epidemic, civil disturbance, structural collapse, insect infestation, transportation, and potable water. Also discussed was the threat of terrorism; however, the Planning Committee felt that it was addressed well by other non-public documents. As illustrated in **Table 3-1**, the Planning Committee decided to study civil disturbance, dam/levee failure, drought, earthquake, extreme temperature, flooding, hailstorm, severe winter storm (ice), tornado, windstorm, hazardous materials, and structural fire in detail as part of this planning effort.

Other hazards, such as radon gas, utility failure, pandemic/epidemic, structural collapse, insect infestation, transportation, and potable water were identified as affecting Marion County, but the Planning Committee decided that the risks associated with these hazards were not great enough to require detailed study at this time.

Table 3-1: Hazards Identification

List of Hazards	Hazards with Local Impact	Hazards for Detailed Study
Avalanche	No	
Coastal Erosion	No	
Coastal Storm	No	
Dam/Levee Failure	Yes	Yes
Drought	Yes	Yes
Earthquake	Yes	Yes
Expansive Soils	No	
Extreme Temperature	Yes	Yes
Flooding	Yes	Yes
Hailstorm	Yes	Yes
Hurricane	No	

List of Hazards	Hazards with Local Impact	Hazards for Detailed Study
Land Subsidence	No	
Landslide	No	
Radon Gas	Yes	No
Severe Winter Storm (Ice)	Yes	Yes
Tornado & Windstorm	Yes	Yes
Tsunami	No	
Volcano	No	
Wildfire	No	
Hazardous Material	Yes	Yes
Fire	Yes	Yes
<i>Utility Failure</i>	Yes	No
<i>Pandemic/Epidemic</i>	Yes	No
Civil Disturbance	Yes	Yes
<i>Structural Collapse</i>	Yes	No
<i>Insect Infestation</i>	Yes	No
<i>Transportation</i>	Yes	No
<i>Potable Water</i>	Yes	No

Note: The Planning Committee added hazards shown in italics. Hazards shown in bold are studied in detail as part of this planning effort.

Once the hazards were identified, the Planning Committee prioritized these hazards in terms of importance and potential for disruption to the community using the Calculated Priority Risk Index (CPRI). The CPRI was adopted from MitigationPlan.com, a software package designed to assist emergency management agencies in fulfilling FEMA requirements, and is a tool by which individual hazards can be evaluated and ranked according to an indexing system. The CPRI value was obtained by assigning varying degrees of risk to four categories (probability, magnitude/severity, warning time, and duration) for each hazard, and then calculating an index value based on a weighting scheme. To determine the CPRI, a value of 1 through 4 is assigned to the categories for probability (unlikely – highly likely), magnitude/severity (negligible – catastrophic), warning time (more than 24 hours – less than 6 hours), and duration of event (less than 6 hours – greater than 1 week). The following is how the index values are weighted and the CPRI value is calculated. $CPRI = Probability \times 0.45 + Magnitude/Severity \times 0.30 + Warning\ Time \times 0.15 + Duration\ of\ Event \times 0.10$. The CPRI value provides a means to assess the impact of one hazard relative to other hazard within the community.

A CPRI value for each hazard was determined for each NFIP community in Marion County, and then a weighted CPRI value was computed based on the size of each community within Marion County. **Table 3-2** presents each community, population, and the weight that was applied to individual CPRI values to arrive at a combined value for the entire County. Weight was

calculated as a given communities proportion of the County's total area. Thus, the results reflect the relative influence of each community on the overall priority rank.

Table 3-2: Determination of Weighted Average for NFIP Communities

NFIP Community	Area (acres)	% Total Area	Weight Value
City of Indianapolis (Marion County)	238,780.18	92.57%	0.926
City of Beech Grove	2,789.62	1.08%	0.011
City of Lawrence	12,965.00	5.03%	0.050
City of Southport	394.15	0.15%	0.002
Town of Speedway	3,010.63	1.17%	0.012
TOTAL	257,939.58	100.00%	1.000

Table 3-3 illustrates the combined CPRI values for Marion County and NFIP communities. According to the combined CPRI, flooding (3.3) ranked as the number one hazard in followed by dam & levee failure (2.9), tornado & windstorm (2.7), severe winter storm (2.3), civil disturbance (2.2), hailstorm (2.1), hazardous material (2.1), drought (2.0), earthquake (2.0), extreme temperature (1.9), and fire (1.8). In those cases where hazards received the same CPRI value, the Planning Committee discussed and selected that hazard which is a higher priority.

Table 3-3: Combined Calculated Priority Risk Index

	Probability <ul style="list-style-type: none"> • Unlikely • Possible • Likely • Highly Likely 	Magnitude/Severity <ul style="list-style-type: none"> • Negligible • Limited • Critical • Catastrophic 	Warning Time <ul style="list-style-type: none"> • > 24 hrs • 12-24 hrs • 6-12 hrs • < 6 hrs 	Duration of Event <ul style="list-style-type: none"> • < 6 hrs • < 1 day • < 1 wk • > 1 wk 	Weighted Average CPRI
Flooding	Likely – Highly Likely	Limited – Critical	6-12 hrs	< 1 wk	3.3
Dam & Levee Failure	Unlikely – Possible	Negligible – Catastrophic	< 6 hrs – > 24 hrs	< 6 hrs – < 1 wk	2.9
Tornado & Windstorm	Possible – Likely	Negligible – Catastrophic	< 6 hrs	< 6 hrs	2.7
Severe Winter Storm	Likely	Limited	> 24 hrs	< 1 wk	2.3
Civil Disturbance	Unlikely – Possible	Negligible – Limited	> 24 hrs – < 6 hrs	< 6 hrs – < 1 day	2.2
Hailstorm	Possible	Limited	< 6 hrs	< 6 hrs	2.1
Hazardous Materials	Possible	Negligible – Limited	< 6 hrs	< 6 hrs	2.1
Drought	Possible	Limited	> 24 hrs	> 1 wk	2.0
Earthquake	Unlikely – Possible	Limited	< 6 hrs	< 1 day	2.0
Extreme Temp	Possible	Limited	> 24 hrs	< 1 wk	1.9
Fire hazard	Unlikely	Limited	< 6 hrs	< 1 day	1.8

Hazards selected for detailed study do not necessarily pose equal threats to all Marion County NFIP communities. While riverine and flash flooding may occur in all the NFIP communities, the greatest losses from flooding would be in the City of Indianapolis because of the large number of critical and non-critical facilities located in the White River floodplain. An extensive network of levees protects much of downtown Indianapolis from 100-year flood events. For these structures protected by levees, a failure could be devastating. Similarly, a significant portion of the Town of Speedway is protected by levees along Eagle Creek. The magnitude and extent of damage from the failure of one of the high hazard dams in Marion County would be greatest to the City of Indianapolis and the City of Lawrence (downstream from Geist Reservoir) as well as the City of Indianapolis and the Town of Speedway (downstream from Eagle Creek Reservoir). Both the City of Southport and City of Beech Grove sit outside of both dam break inundation zones.

Due to the number of critical facilities and non-critical facilities in the City of Indianapolis, the impact of a tornado and/or windstorm could be catastrophic more so than in the City of Beech Grove, City of Lawrence, City of Southport, and Town of Speedway. Civil disturbance was another hazard that would most likely affect only the City of Indianapolis and the Town of Speedway since both communities host major events with large public gatherings. The dangers associated with the storage and transportation of hazardous materials could have a greater impact on the City of Indianapolis, Town of Speedway, and City of Beech Grove because of the number of facilities as well as their proximity to I-465, which is a designated hazardous material route in Marion County.

However, other hazards such as severe winter storms, hailstorm, drought, earthquake, and extreme temperature tend to impact regional areas, and all Marion County NFIP communities are equally likely to be impacted by one of these hazards. The extent of damage associated with these hazards is also likely to be similar from community to community. **Section 3.2** includes a profile of each hazard as well as a CPRI value for each NFIP community within Marion County.

3.2 HAZARD PROFILES

The following profiles each of the hazards that the Planning Committee selected for additional investigation. Each hazard is discussed in terms of the causes, effects and characteristics that the hazard presents to the communities including an overview of the significant historic hazard events and the probability of future event. A community vulnerability assessment follows the hazard profile and describes, in general terms, the current exposure, or risk, to the community regarding potential losses to critical facilities and infrastructure. Finally, existing mitigation practices are discussed and future risk related to growth and development.

3.2.1 FLOODING

Floods are the most common and widespread of all natural disasters.. Most communities in the United States have experienced some kind of flooding, after spring rains, heavy thunderstorms, or winter snow thaws. A flood, as defined by the NFIP, is a general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties from overflow of inland or tidal waters and unusual and rapid accumulation or runoff of surface waters from any source, or a mudflow. Floods can be slow or fast rising but generally develop over a period of days. Mitigation includes any activities that prevent an emergency, reduce the chance of an emergency happening, or lessen the damaging effects of unavoidable emergencies. Investing in mitigation steps now, such as, engaging in floodplain management

activities, constructing barriers, such as levees, and purchasing flood insurance will help reduce the amount of structural damage to the homes and financial loss from building and crop damage should a flood or flash flood occur.

Flooding may be attributed to heavy, widespread general rains and/or snowmelt in the winter and spring. As well as flooding during high intensity, short duration storms in the summer and fall, although it can occur at any time.



Flooding: Historic Data

Marion County is drained by numerous rivers, creeks, brooks, runs and ditches, all of which eventually flow into the White River (although Buck Creek takes a circuitous route via the Big Blue River). As shown in **Exhibit 2**, the White River flows predominantly from north to south through the County and downtown Indianapolis. The two largest tributaries of the White River are Eagle Creek and Fall Creek. Eagle Creek flows from the north-west of the County, through the Town of Speedway, and then drains into the White River downstream of downtown Indianapolis. Fall Creek flows from the northeast, along the northern boundary of the City of Lawrence, and joins White River upstream of downtown Indianapolis. The Eagle Creek Dam, located in the northwest corner of the County and Geist Reservoir, located on the northeast corner, regulate water levels for Eagle Creek and Fall Creek respectively.

Although there are a number of waterways in Marion County that could flood, the majority of flooding problems are along the White River. Approximately 18% or 46,234 acres of the County is the 100-year and 500-year floodplain, 31.3% of which is along the White River. The river valley of the White River is flat and wide with a significant floodplain area equal to approximately 6% or 14,450 acres of the land area in the County. With the exception of where flood control structures narrow the floodplain, the 100-year floodplain can be as great as 1 to 2 miles wide. Much of this floodplain area has been developed, and subsequently floods.

The City of Indianapolis' Flood Preparedness Plan has identified 6 areas along the White River that are most likely to flood. As shown on **Exhibit 3A – 3C**, these areas include portions of the Union Chapel, Beach Avenue, 77th Street, Ravenswood, Frog Hollow, and High Acre Manor neighborhoods. Following the most recent flood in January 2005, the City of Indianapolis Building Inspectors documented flood damage to the structures in these areas as well as 2 additional structures along Fall Creek. Residents in the Ravenswood, Union Chapel, and Frog Hollow neighborhoods are at an additional health risk due to their reliance on septic system and private wells. Flooding will most likely cause septic systems to fail and/or contaminate drinking water. The Marion County Health Department (MCHD) has targeted these areas as well as identified 2 additional areas that have experienced significant flooding in the past and do not have city sewer or water service. These include the Rocky Ripple, and Edgewater neighborhoods.

There are 63 repetitive loss structures in Marion County. As shown on **Exhibit 4**, all of these structures are located within the City of Indianapolis and primarily located along the White River in the Union Chapel, Beach Avenue, and Ravenswood neighborhoods. A repetitive loss structure is defined as a structure (with flood insurance) that has suffered flood damages on two

occasions during a 10-year period and where the cost to repair the flood damage, on average, equaled or exceeded 25% of the market value of the structure at the time of each flood loss.

The 1999 City of Indianapolis Floodplain Prioritization Study identified 33 waterways with known significant flooding problems. Flooding problems ranged from occasional flooding of less than 1 foot and minimal property damage to frequent flooding with 2 or more feet of flooding and excessive property damage. Although all of Marion County was inventoried, very few of these flooding areas were identified in the City of Beech Grove, City of Lawrence, City of Southport, and Town of Speedway. As shown in **Exhibit 5**, these areas include substantial portions of White River (above and below downtown Indianapolis), Fall Creek, Pogues Run, Pleasant Run, Bean Creek, Lick Creek, Little Buck Creek, Hauelsen Ditch, and State Ditch.

Of the floods that have been recorded, the Flood Insurance Study (FIS) for Marion County lists 8 significant floods between 1904 and 1990. The National Climatic Data Center (NCDC) has identified 34 significant floods between November 1993 and January 2005. Damage estimates are not readily available for the FIS listed floods and the NCDC lists only the total property and crop damage, which, unless specified, may be reported from multiple counties. Based on the NCDC data, the total loss reported for all flood events was approximately \$108.2 million of property damage and \$12.5 million of crop damage during the 12-year period. Additionally, 5 deaths were attributed to flooding during the same period. **Table 3-4** lists the historic floods from the FIS and the NCDC where damage was reported in Marion County.

Table 3-4: Historic Flood Data

Location	Date	Flood Frequency ¹	Death/Injuries	Property/Crop Damage
Marion County	3/1904	42	NA	NA
Marion County	3/1913	300	NA	NA
Marion County	2/1916	42	NA	NA
Marion County	3/1927	22	NA	NA
Marion County	1/1930	14	NA	NA
Marion County	5/1943	16	NA	NA
Marion County	4/1964	13	NA	NA
Marion County	12/1990	17	NA	NA
Central/South IN (58 counties affected)	11/14/1993	10-yr	0/0	\$5 M/\$5 K
North/Central IN (31 counties affected)	4/12/1994	<10-yr	1/0	\$5 K/\$0
Central IN (11 counties affected)	1/21/1999	<10-yr	0/0	\$19 M/\$0
Central IN (5 counties affected)	1/22/1999	<10-yr	0/0	\$1.1 M/\$0
Central IN (6 counties affected)	5/12/2002	<10-yr	0/0	\$500 K/\$0
Central IN (7 counties affected)	7/5/2003	25-yr	0/0	\$41.6 M/\$12 M

Central IN (35 counties affected)	9/1/2003	25-yr	0/0	\$31.5 M/\$0
North/Central/South IN (60 counties affected)	1/3/2005	<50-yr	0/0	\$9 M/\$0
TOTAL			5/0	\$108.2 M/\$12.5 M

¹ Flood frequency from FIS or estimated based on peak discharge at White River gage at Indianapolis (USGS Gage No 03-353000) flood frequency may vary between counties affected. (FIS, 2005; NCDL, 2005; USGS, 2004)

According to the reported damage data available through the NCDL, the 25-year flood (as recorded on the White River – Indianapolis stream gage) on July 5, 2003 was the most costly for the 7 counties affected – Delaware, Hamilton, Johnson, Madison, Marion, Morgan, and Owen Counties. Numerous thunderstorms rolled across central Indiana from the evening of the 4th through the 11th. This caused near major flooding along the White River in the communities of Nora, Broad Ripple, and Ravenswood in Marion County. Two months later, another 25-year flood (as recorded on the White River – Indianapolis stream gage) on September 1, 2003 dumped 8 to 10 inches of rain across central Indiana over a 30 hour period. This caused major flooding along the White River and widespread flash flooding and flooding along numerous tributaries and small creeks. The City of Indianapolis received the most rain ever in a calendar day (7.2 inches) breaking an old record set in 1895 (6.8 inches). It should be noted that although the frequency of the Labor Day 2003 flood is determined to be about a 25-year flood based on the White River – Indianapolis stream gage, this flood represented a 100-year to 200-year frequency flooding in many smaller tributaries within the region. Three thousand residents from 35 counties in central Indiana applied for flood assistance and many neighborhoods in Indianapolis that never saw flooding before were flooded. The National Guard was activated to help with road closing and rescues at the request of the City of Indianapolis.

The Planning Committee discussed the probability, magnitude or severity, warning time, and duration of flood events in Marion County and decided that the probability of a flood in the City of Indianapolis, especially along the White River is highly likely with a critical severity on the neighborhoods affected. The probability of a flood is likely in the City of Southport and the Town of Speedway. However, the severity, as with in the cities of Beech Grove and Lawrence, would be limited. **Table 3-5** identifies the Calculated Priority Risk Index (CPRI) for a flood event for all NFIP communities in Marion County.

Table3-5: Calculated Priority Risk Index for Flooding

	Probability <ul style="list-style-type: none"> • Unlikely • Possible • Likely • Highly likely 	Magnitude/ Severity <ul style="list-style-type: none"> • Negligible • Limited • Critical • Catastrophic 	Warning Time <ul style="list-style-type: none"> • > 24 hrs • 12-24 hrs • 6-12 hrs • < 6 hrs 	Duration of Event <ul style="list-style-type: none"> • < 6 hrs • < 1 day • < 1 wk • > 1 wk 	CPRI
City of Indianapolis	Highly Likely	Critical	6–12 hours	< 1 week	3.5
City of Beech Grove	Possible	Limited	6–12 hours	< 1 week	2.3
City of Lawrence	Possible	Limited	6–12 hours	< 1 week	2.3
City of Southport	Likely	Limited	6–12 hours	< 1 week	2.7

Town of Speedway	Likely	Limited	6–12 hours	< 1 week	2.7
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According to the CPRI, only the City of Indianapolis shows that flooding is expected on a near yearly basis and that flooding has a pronounced effect on community function.

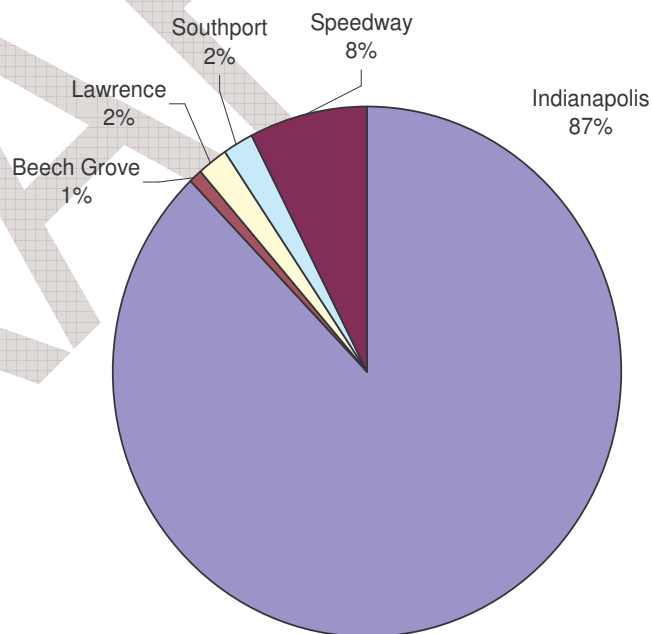
Flooding: Vulnerability Assessment

In order to determine the number of structures in the floodplain, structures greater than 600 square feet (to exclude sheds and garages) from the most recent Marion County building layer were overlaid on the FEMA floodplain boundaries. According to this analysis, there are approximately 28,632 buildings within the known flood hazard area. Known flood hazard areas include delineated 500-year boundary and 100-year flood boundary (including floodway) and approximate 100-year floodplain boundaries as defined on the most recent FIRMs. Of this total, 1,869 (17 critical and 1,852 non-critical facilities) are located in the regulatory floodway, 14,719 (44 critical and 14,675 non-critical facilities) are located within the studied floodway fringe area or approximate zones, and 12,044 (45 critical and 11,999 non-critical facilities) are shown between the 100-year and 500-year floodplain boundaries (where determined).

Of the 106 critical facilities located in the known flood hazard areas, 93 (87.7%) are in the City of Indianapolis. The Town of Speedway accounts for 7.5%, City of Lawrence 1.9%, the City of Southport 1.9%, and the City of Beech Grove 0.9% each.

Figure 3-1 illustrates the distribution of critical facilities in known flood hazard areas and **Appendix 6** lists the critical facilities by NFIP community. Of the 28,526 non-critical facilities in known flood hazard areas, the majority (88.7%) are residential and located along the White River, State Ditch, and Lick Creek. This analysis is based on the floodplains shown on the most recent FIRMs. There are levees along portions of the White River, Fall Creek, and Eagle Creek that may provide varying degrees of flood protection. However, some of these levees are not recognized by FEMA and as a result, the FIRM still shows the protected area as floodplain. For the purpose of this Plan, the effect of these “non-certified” levees has been ignored.

Figure 3-1: Critical Facilities in Floodplains



To estimate the exposure to flood damage countywide, it is assumed that 25% of all critical and non-critical structures in the known flood hazard areas would be destroyed, 35% would be 50% damaged, and 40% would have only 25% damage. A median replacement value, based on Marion County data, was determined for each occupancy class – residential commercial, industrial, government, education, and religious land uses. Thus, damage to the structures, content, and land from a major flood in Marion County is estimated at \$7.7 million for critical facilities and \$1.9 billion for non-critical facilities. Grants for mitigation project funds will require

detailed analysis as part of a required benefit-cost ratio determination but that is beyond the scope and intent of this MHMP.

Damage estimates were calculated for each of the 33 waterways with known significant flooding problems identified in the 1999 City of Indianapolis Floodplain Prioritization Study. As shown in **Exhibit 5**, the waterways with the highest damage estimates are the White River, State Ditch, Lick Creek, Falcon Creek, and Eagle Creek. Based on the above assumptions for flood damage, it is estimated that there could be \$524.0 million in damage to the 7749 structures (critical and non-critical facilities) in the White River known flood hazard area. Approximately 5% of the estimated damage along the White River (\$26.9 million) is to the 402 structures in the floodway. Eighty-seven percent of the structures in the White River floodway are residential.

Based on the most recent 500-year FIRM boundary, the estimated damage along the White River is almost 4 times as large as the next highest damage estimate of \$133.9 million along State Ditch followed by \$87.0 million along Lick Creek, \$71.8 million along Falcon Creek, and \$67.2 million along Eagle Creek. Next to the White River, Lick Creek has the next highest damage (\$15.2 million) and number of structures (225) in the floodway. Similar to the White River, 85.7% of the structures in the Lick Creek floodway are residential. **Appendix 7** contains a summary of the damage estimates for all 33 waterways.

Preliminary results from a detailed flood hazard identification restudy currently being undertaken for Lick Creek indicate that the number of structures in the 100-year floodplain may be reduced by as much as 50%. However, the number of structures in the floodway remains almost the same. Comparison of these preliminary findings and those calculated based on the current FIS study seems to indicate that Lick Creek floodplain remains as one of the highest flood damage potential floodplain corridors within Marion County.

As part of this planning effort, the GIS-based HAZUS-MH Flood Model was used to calculate social, physical, and economic losses. However, the results were not realistic and were discarded by the Planning Committee.

Flooding: Existing Mitigation Practices

Mitigation practices are projects, policies, or programs that reduce the social, physical, and economic impact of hazards. As part of this planning process, the Planning Committee discussed the strengths and weaknesses of existing mitigation practices and made recommendations for improvements as well as suggested new practices. The following is a summary of the mitigation practices discussed. A chart detailing all of the existing and proposed mitigation practices, hazards address, local priority, benefit-cost ratio, location, responsible entity, and funding can be found in **Section 4.0** of this Plan.

Flood monitoring systems such as USGS stream gages, field observation, and vigilant attention to local weather systems are used in Marion County to monitor continuous changes in water levels on local waterways. These monitoring systems, in partnership with local media weather warnings and advisories reduce potential losses by providing needed time to prepare and take action to remove persons and protect property as well as mobilize emergency response personnel. Currently there are 44 stream gages in or upstream of Marion County. Exhibit 2 illustrates the location of USGS stream gages throughout Marion County. Flood levels upstream of the City of Indianapolis is monitored at 20 locations, the City of Lawrence has 3 gages upstream, including the base of Geist Reservoir, the Town of Speedway has 4 gages upstream, including the base of Eagle Creek Reservoir, the City of Southport has 2 gages

upstream, and the City of Beech Grove has none. Appendix 5 list the USGS stream gages within and immediately upstream of Marion County.

Historically, efforts to control flooding or to protect floodplain areas within the City of Indianapolis have been initiated in response to citizen's complaints. In an effort to take a more proactive approach to flooding problems, in 1999 the City prepared a Floodplain Prioritization Study. This Study identified stream reaches with significant flooding problems; stream reaches with incompatible floodplain information and/or constraints; and prioritized reaches into 3 categories for future study. This Study has been an effective means to guide planning and projects to mitigate flooding problems. The intent of this Floodplain Prioritization Study was for it to become a living document with regular updates. In the 6 years since the Plan was completed there have been many studies, including updated FIRMs, and significant flood control projects completed in Marion County that may affect future prioritization of waterways with known significant flooding problems. The City of Indianapolis should update the 1999 Floodplain Prioritization Study to reflect recent flood control efforts.

In 2002, an Analysis of One Square Mile Cutoff Points for Streams and Creeks in Marion County was completed. This analysis provided a preliminary screening that determined 27.4 miles of Marion County streams had approximate Zone A designation while draining less than one square mile. In addition, 87.4 miles had approximate Zone A designation while draining more than one square mile, and 16.6 miles had no studies at all despite draining more than one square mile. FEMA defines Zone A as the flood insurance rate zone that corresponds to the 100-year floodplains as determined in the FIS by approximate methods. Because detailed hydraulic analyses have not been completed, the base flood elevations or flood depths are unknown. Knowing where the one-mile cutoff for these and other unstudied streams is located and whether the level of existing floodplain study detail is appropriate for the stream reach has greatly benefited the City staff with planning new floodplain studies as well as regulating new development along these reaches. In summary, this analysis identified a total of approximately 129 miles of unstudied reaches on 125 different streams. To better understand the flooding problems in Marion County, it is important that detailed studies, that are consistent from reach to reach, be completed for all approximate Zone A unstudied streams. This should be a priority mitigation project to more accurately identify the flood risk areas and implement measures to reduce the physical, social, and economic impacts of flooding throughout Marion County.



Once flood studies have been completed, the recommendations need to be evaluated and implemented in order to successfully reduce flood losses throughout the County. Detailed flood protection studies have been completed for the neighborhoods along the White River that flood on a regular basis however due to limited resources, the recommendations have not been implemented. Once this MHMP is approved, the City of Indianapolis, City of Beech Grove, City of Lawrence, City of Southport, and the Town of Speedway will be eligible for mitigation

project funds from FEMA to reduce flood losses in these neighborhoods and elsewhere in the County.

The Comprehensive Land Use Plan is a powerful planning tool for flood mitigation since it defines how and where a community should be developed. The goals and objectives identified in the Plan become the foundation for all development ordinances in the community. Flood hazard areas are identified in the Comprehensive Land Use Plan for Marion County. Floodplains are labeled environmentally sensitive areas, and floodways have been designated as areas not to be developed. Marion County is in the process of updating the 1990 Comprehensive Land Use plan. Similar to the 1990 Plan, the 2005 Plan is divided into 9 township-based Plans and includes the City of Indianapolis, City of Beech Grove, City of Lawrence, City of Southport, and the Town of Speedway. At this time, 7 of the 9 township-based plans have been adopted. Each of the incorporated communities has recently formed their own redevelopment authority, which will facilitate local implementation of the larger Comprehensive Land Use Plan.

The Flood Control District Zoning Ordinance regulates development in the floodplain. This ordinance was last amended in 2005 to include the most recent FIRM boundary updates. All of the NFIP communities have adopted the countywide ordinance however; with the exception of the City of Southport, they have their own Board of Zoning Appeals (BZA) to address variances. Variances within the City of Southport are heard by the Metropolitan Board of Zoning Appeals, which serves Indianapolis/Marion County. Permitted uses in the floodway are restricted to open land use, land alteration and watercourse alteration, non-building structures, detached residential accessory structures, and improvements, additions, and restoration of damage to legally established nonconforming uses. No building in the floodplain (referred to in ordinance as floodway fringe) is to be erected, reconstructed, expanded, structurally altered, converted, used, relocated, restored, or improved unless it is provided with flood protection of at least 2 feet above the base flood elevation. The flood protection grade may be achieved for nonresidential structures by certified structural floodproofing. The 2-foot elevation freeboard is common through the State of Indiana and it goes above and beyond the minimum FEMA requirement to be at or above the base flood elevation.

As Marion County continues to grow, the pressure to develop in the floodplains continues to increase as well. Preserving the natural flood storage function of an entire floodplain is not a realistic option in the City of Indianapolis or elsewhere in Marion County. The Flood Control District Zoning Ordinance should be expanded to allow for both economic development and preservation of floodplain storage through a no net loss floodplain storage policy. Compensatory storage is the replacement of the existing floodplain and, in rare exceptions, the floodway storage lost due to fill. Storage is required when a portion of the floodplain is filled, occupied by a structure, or when as a result of a project a change in the channel hydraulics occurs and reduces the existing available floodplain storage. Compensatory storage should be located adjacent or opposite the placement of the fill and maintain an unimpeded connection to the adjoining floodplain area. The counties surrounding Marion County, also experiencing growth and development pressure, have successfully adopted a no net loss of floodplain storage policy as part of their NPDES Phase II Storm Water Management Ordinance.

Approximately 9% (28,664) of the 324,301 buildings in Marion County are located within known flood hazard areas. Known flood hazard areas include delineated (including floodway) and approximate floodplains as defined on the most recent FIRMs. Of those in known flood hazard areas, 106 are critical facilities with 17 located in the floodway. Due to their importance to the

community, critical facilities, as well as access to them need to remain unaffected by rising floodwaters. Although the majority (92.5%) is located in the City of Indianapolis, all of the NFIP communities in Marion County should secure funding from FEMA to assist landowners with acquisition, relocation, elevation, and floodproofing of critical facilities in flood hazard areas. All future critical facilities should be prohibited in the floodplains. Once the 106 critical facilities are protected from future flood damage, the NFIP communities should begin to acquire, relocate, elevate, and floodproof (non-residential only) the 28,526 non-critical facilities located in the known flood hazard areas.

In 2004, the FEMA reported 5,497 flood insurance premiums in Marion County (5,471 in the City of Indianapolis and 7 in the City of Beech Grove). The total coverage was estimated at \$653 million. There are also 63 repetitive loss structures along the White River in the City of Indianapolis. In order to reduce the premiums paid on flood insurance, the NFIP communities in Marion County should consider joining the NFIP Community Ratings System (CRS). The CRS is a voluntary incentive program that recognizes and encourages community floodplain activities that exceed the minimum NFIP requirements. Floodplain activities are assigned points and the higher the points, the higher the flood insurance premium discount. A minimum of 500 points are necessary to enter the CRS program, which equates to a 5% discount in flood insurance premiums. Because Marion County has more than 10 repetitive loss structures, a Flood Mitigation Plan or Multi-Hazard Mitigation Plan must be adopted before joining the program. Participation and adoption of this MHMP could contribute as many as 294 points toward the 500 points needed to join the CRS program.

Following a flood event, each community may assign their own building inspectors to conduct damage assessments and document damage within their respective community. Currently there is little coordination among the various NFIP community building inspectors with respect to what data they are collecting, how it is reported, and in what format. If all of the inspection staff and reporting forms were coordinated, this could dramatically improve documentation of flood damage and subsequently faster federal and state relief funding.

The coordination of staff is important when responding to a flood event, it is also important as a prevention mitigation measure. In the late 1990s, multiple departments and agencies in Marion County met on a monthly basis to discuss planning efforts and coordination and scheduling of projects in each of the 6 11-digit hydrologic unit code watersheds that drain land in Marion County. This was one of the few opportunities for staff to communicate and interact with other departments and agencies in the County to address water quality and water quantity issues. Re-establishing the multi-department watershed teams could improve the coordination of planning and efficiency of project implementation to address flooding problems throughout the County.

As part of this planning effort, the GIS-based HAZUS-MH Flood Model was used to calculate social, physical, and economic losses. However, the results from the countywide analysis were not realistic and were discarded by the Planning Committee. HAZUS-MH may be used to successfully estimate losses in "what if scenarios". These scenarios could aid with planning efforts as well as determining the benefit-cost ratios necessary for mitigation planning grant applications. Although HAZUS-MH is recommended by FEMA, it is not a substitute for detailed engineering studies. GIS staff at the City of Indianapolis has already successfully completed the advanced HAZUS-MH flood-modeling course. For accurate results, local GIS data will have to be imported, using compatible classification, into HAZUS-MH.

Social, physical, and economic losses from flooding could be significantly reduced with additional flood studies, implementation of completed studies, floodplain management, and coordination of staff in Marion County. Ensuring that residents and business owners are well informed about the potential impacts from flooding and proper methods to protect themselves and their property will help reduce future losses and damage.

3.2.2 DAM & LEVEE FAILURE

A dam is defined as a barrier constructed across a watercourse for the purpose of storage, control, or diversion of water. Dams typically are constructed of earth, rock, concrete, or mine tailings. A dam failure is the collapse, breach, or other failure resulting in downstream flooding.



A dam impounds water in the upstream area, referred to as the reservoir. The amount of water impounded is measured in acre-feet. An acre-foot is the volume of water that covers an acre of land to a depth of one foot. As a function of upstream topography, even a very small dam may impound or detain many acre-feet of water. Two factors influence the potential severity of a full or partial dam failure: the amount of water impounded, and the density, type, and value of development and infrastructure located downstream.

Of the approximately 80,000 dams identified nationwide in the National Inventory of Dams, the majority are privately owned. Federal agencies own 2,131; States own 3,627; local agencies own 12,078; public utilities own 1,626; and private entities or individuals own 43,656. Ownership of over 15,000 is undetermined. The Inventory categorizes the dams according to their primary function: Recreation (31%), Fire and farm ponds (17%), Flood control (15%), Irrigation (14%), Water supply (10%), Tailings and other (8%), Hydroelectric (3%), and Undetermined (2%).

Each dam in the National Inventory of Dams is assigned a downstream hazard classification based on the potential loss of life and damage to property should the dam fail. The three classifications are high, significant, and low. With changing demographics and land development in downstream areas, hazard classifications are updated continually. The hazard classification is not an indicator of the adequacy of a dam or its physical integrity. Dam failures typically occur when spillway capacity is inadequate and excess flow overtops the dam, or when internal erosion (piping) through the dam or foundation occurs. Dam failures can result from any one or a combination of the following causes:

- Prolonged periods of rainfall and flooding, which causes most failures;
- Inadequate spillway capacity, resulting in excess overtopping flows;
- Internal erosion caused by embankment or foundation leakage or piping;
- Improper maintenance, including failure to remove trees, repair internal seepage problems, replace lost material from the cross section of the dam and abutments;

- Improper design, including the use of improper construction materials and construction practices;
- Negligent operation, including failure to remove or open gates or valves during high flow periods;
- Failure of upstream dams on the same waterway;
- Landslides into reservoirs, which cause surges that result in overtopping;
- High winds, which can cause significant wave action and result in substantial erosion; and
- Earthquakes, which typically cause longitudinal cracks at the tops of embankments that weaken entire structures.



A Levee is a flood control structure designed to hold water away from a building. Levees protect buildings from flooding as well as from the force of water, scour at the foundation and impacts of floating debris. The principle causes of levee failure are similar to those associated with dam failure and include overtopping, surface erosion, internal erosion, and slides within the levee embankment or the foundation walls. Levees are designed to protect against a particular flood level and they may be overtopped in a more severe event. When a levee system fails or is

overtopped, the result can be more damaging than if the levee were not there, due to increased elevation differences and water velocity. The water flowing through the breach continues to erode the levee and increase the size of the breach until it is repaired or water levels on the two sides of the levee have equalized.

Dam & Levee Failure: Historic Data

There are 14 dams in Marion County as shown in **Exhibit 6**. Four of these are classified as high hazard dams, 3 as significant hazard dams, and 7 as low hazard dams. High hazard dams include Eagle Creek Reservoir Dam on Eagle Creek, Geist Reservoir Dam on Fall Creek, Castlebrook Dam on an unnamed tributary of Mud Creek, and College Park Lake Dam on Crooked Creek. Twelve of the 14 dams are upstream from the City of Indianapolis and the remaining 2 are upstream from the Town of Speedway. At the time this MHMP was being prepared, Emergency Action Plans (EAP) were not available for any of these dams. **Table 3-6** provides a summary of the dams in Marion County.

Table 3:6: Inventory of Dams

Name	Type & Height	Overall Condition ¹	Waterway & Downstream Community	Owner	Hazard Potential (EAP) ²
Eagle Creek Reservoir Dam	Concrete 92'	Conditionally Poor	Eagle Creek Speedway & Indianapolis	City of Indianapolis	High (No)
Geist Reservoir Dam	Concrete 44'	Fair	Fall Creek Indianapolis	Indianapolis Water Co.	High (No)
Castlebrook Dam	Earth 42'	Conditionally Poor	UNT Mud Crk Indianapolis	Private	High (No)
College Park Lake Dam	Earth 21'	Fair	Crooked Creek Indianapolis	College Life Development Corporation	High (No)
Warren Lake Dam	Earth 25'	Fair	Eagle Creek Speedway	Private	Significant (No)
Pogues Run Dam	Concrete 24'	Fair	Pogues Run Indianapolis	City of Indianapolis	Significant (No)
Indian Lake Dam	Earth 24'	Conditionally Poor	Indian Creek Indianapolis	Indian Lake Improvement Association	Significant (No)
Traders Point Lake Dam	Earth 17'	Conditionally Poor	Eagle Creek Speedway	Lakeside Improvement Association	Low (No)
Lux Lake Dam	Earth 32'	NA	UNT Fall Crk Indianapolis	Private	Low (No)
Emerichsville Dam (In-Channel)	Concrete 10'	Acceptable	White River Indianapolis	City of Indianapolis	Low (No)
Broad Ripple Dam (In-Channel)	Concrete 10'	Conditionally Poor	White River Indianapolis	Indianapolis Water Co.	Low (No)
Harding Street Power Plant Dam (In-Channel)	Concrete 10'	Poor	White River Indianapolis	Indianapolis Power & Light Co.	Low (No)
White River Dam (In-Channel)	Concrete 10'	Poor	White River Indianapolis	Indianapolis Power & Light Co.	Low (No)
Fall Creek Keystone Avenue Dam (In-Channel)	Concrete 7'	Fair	Fall Creek Indianapolis	Indianapolis Water Co.	Low (No)

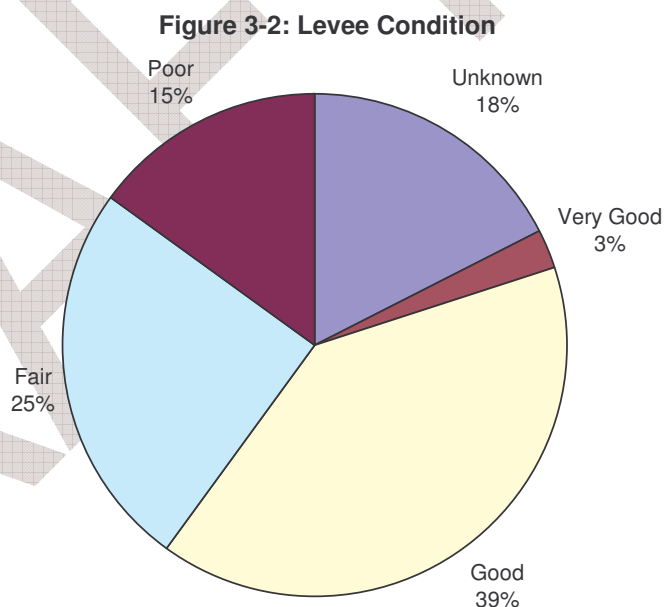
¹ IDNR Dam Inspection Report² Emergency Action Plan (EAP)
(NID, 2005; IDNR, 2005)

According to the most recent dam inspection report from IDNR, 7 of these dams are in conditionally poor to poor condition. Conditionally poor dams have a potential safety deficiency

that warrants further investigation and studies. Poor dams have a clear safety deficiency for normal load conditions and immediate action is recommended otherwise reservoir restrictions may be necessary until the problem is resolved. Two of the high hazard dams (Eagle Creek Reservoir Dam and Castlebrook Dam), 1 significant hazard dams (Indian Lake Dam), and 4 of the low hazard dams (Traders Point Lake Dam, Broad Ripple Dam, Harding Street Power Plan Dam, and White River Dam) are listed as conditionally poor or poor.

According to the 2003 Levee Inspection Report, there are 40 known levee flood control structures in Marion County. These include 33.9 miles of earthen levees, concrete-armored earthen levees, concrete floodwalls, and/or sheet piling structures along one or both sides of White River, Eagle Creek, Little Eagle Creek, Fall Creek, and Pogues Run. As shown on Exhibit 6, there are 19 levees (15.6 miles) along White River, 13 levees (13.6 miles) along Eagle Creek, 3 levees (0.9 miles) along Little Eagle Creek, 4 levees (3.2 miles) along Fall Creek, and 1 levee (0.6 miles) along Pogues Run. In addition, there are levees along the White River at 82nd Street and on Howland Ditch (generally to the south of Wyandotte School) that are not in the 2003 Levee Inspection Report.

According to the 2003 Levee Inspection Reports, 3% of all the levees in Marion County are in very good condition, 48% in good condition, 30% in fair condition, and 18% in poor condition. The levees in poor condition, and most likely to fail, are the Buck Creek Levee, County Line Levee, and Big Four – Morris Levee on the White River and the Raymond West Levee, US 136/Dandy Trail, and Lafayette Road Levee on Eagle Creek. Five are earthen levees and one is a concrete-armored earthen levee. The Levee Inspection Report documented problems with heavy brush, dense trees, streambank erosion, depressions, erosion and ruts on the crown and slopes from ATV and local traffic, small structures, fences, utility poles, and equipment storage encroaching on the levees. There are 7 levees in Marion County that are lower than the 100-year flood elevation. These include County Line/Park Levee, Mann Hill – Southport Road Levee, and Raul Levee on White River, Conrail /21st Street Levee on Eagle Creek, Washington/Cossell East and West Levees on Little Eagle Creek, and Lafayette/Westview Hospital Levee on Pogues Run. **Figure 3-2** graphically illustrates the condition of the levees in Marion County and **Appendix 8** includes a summary of the 2003 Levee Inspection Reports.



There have been no recorded prior dam or levee failure events in Marion County. Nonetheless, there is a possibility that one could occur resulting in catastrophic damage to the City of Indianapolis and the Town of Speedway. **Table 3-6** identifies the CPRI for a dam and/or levee failure event for all NFIP communities in Marion County.

Table 3-6: Calculated Priority Risk Index for Dam & Levee Failure

	Probability <ul style="list-style-type: none"> • Unlikely • Possible • Likely • Highly likely 	Magnitude/Severity <ul style="list-style-type: none"> • Negligible • Limited • Critical • Catastrophic 	Warning Time <ul style="list-style-type: none"> • > 24 hrs • 12-24 hrs • 6-12 hrs • < 6 hrs 	Duration of Event <ul style="list-style-type: none"> • < 6 hrs • < 1 day • < 1 wk • > 1 wk 	CPRI
City of Indianapolis	Possible	Catastrophic	< 6 hours	< 1 week	3.0
City of Beech Grove	Unlikely	Negligible	> 24 hours	< 6 hours	1.0
City of Lawrence	Possible	Critical	< 6 hours	< 1 week	2.7
City of Southport	Unlikely	Negligible	> 24 hours	< 6 hours	1.0
Town of Speedway	Possible	Catastrophic	< 6 hours	< 1 week	3.0

According to the CPRI, the 3 communities (City of Indianapolis, City of Lawrence, and the Town of Speedway) that are located downstream of high hazard dams show greater CPRI values. The same is true for the 2 communities (City of Indianapolis and the Town of Speedway) that have structures protected by levee flood control structures.

Dam & Levee Failure: Vulnerability Assessment

Due to conditions beyond the control of the dam or levee owner, there are unforeseen structural problems, natural forces, mistakes in operation, negligence, or vandalism that may cause the dam or levee to fail. A detailed inundation map showing the area affected by a dam or levee failure is necessary to estimate the potential social, physical, and economic loss.

Since none of the dam owners in Marion County have published Emergency Action Plans (EAP) with detailed dam break inundation areas, a “Rule of Thumb” dam breach/flood wave height determination method was used to estimate the inundation zones associated with potential dam failures. This procedure is intended to be a very rough, conservative estimation, and many assumptions were made. This analysis is not intended to be a substitute for detailed dam breach analyses. Based on this preliminary analysis, there are 272 critical and 40,245 non-critical facilities located in potential dam inundation areas for all 4 of the high hazard dams in Marion County. These facilities do not include bridges and roadways that are in the floodway and floodplains throughout the County that could be damaged or destroyed by a dam failure.

The estimated inundation area resulting from complete failure of the Geist Reservoir Dam includes the northern edge of the City of Lawrence within the Fall Creek floodplain into downtown Indianapolis as well as flooding upstream and downstream on the White River. There are 199 critical facilities and 23,996 non-critical facilities in this dam break inundation area. Assuming that 25% of all critical and non-critical structures in the downstream inundation zones would be destroyed, 35% would be 50% damaged, and 40% would have only 25% damage. A median replacement value, based on Marion County data, was determined for each occupancy class – residential commercial, industrial, government, education, and religious land uses. Damage to structure, content, and land from a complete failure of Geist Reservoir Dam is estimated at \$15.9 million for critical facilities and \$1.6 billion for non-critical facilities.

The effect of a complete failure of the Eagle Creek Reservoir Dam is also significant. The estimated inundation area includes the Eagle Creek floodplain through the Town of Speedway

into downtown Indianapolis as well as flooding upstream and downstream on the White River. There are 92 critical facilities and 20,275 non-critical facilities in this dam break inundation area. The damage from a complete failure of Eagle Creek Reservoir Dam is estimated at \$7.3 million for critical facilities and \$1.4 billion for non-critical facilities.

Failure of the College Park Lake Dam could affect 5 non-critical facilities bordering Crooked Creek and Castlebrook Dam could impact 9 non-critical facilities on an unnamed tributary of Mud Creek. The estimated damage is \$400,000 and \$589,000 respectively. **Table 3-7** summarized the estimated damage as a result of a dam failure in Marion County.

Table 3-7: Estimated Damage from Dam Failure

	Number of Critical Facilities	Number of Non-Critical Facilities	Total Estimated Damage
Geist Reservoir Dam	199	23,996	\$1.6 B
Eagle Creek Reservoir Dam	92	20,275	\$1.3 B
College Park Lake Dam	0	5	\$400 K
Castlebrook Dam	0	9	\$589 K

Though it is improbable that all dams would fail at the same time, the exposure to a flood wave caused by a dam break is present throughout the county at a significant scale. The magnitude and extent of damage depend on the type of dam break, volume of water that is released, and width of the floodplain valley to accommodate the dam break flood wave.

Levee failure inundation zones were estimated for the White River, Eagle Creek, Fall Creek, and Little Eagle Creek by identifying the structures in the known flood hazard area as though the levee did not exist. This procedure is intended to be a very rough, conservative estimation, and many assumptions were made. This analysis is not intended to be a substitute for detailed levee breach analyses. There are levees along portions of the White River, Fall Creek, and Eagle Creek that may provide varying degrees of flood protection. However, some of these levees are not recognized by FEMA and as a result, the FIRM still shows the protected area as floodplain. Since the estimated damage for these floodplain areas was already included in the flooding vulnerability assessment, the following damage estimates are above and beyond those damage estimates (unless otherwise noted).

Based on this preliminary analysis, there are 20 critical and 2,545 non-critical facilities located in potential levee inundation areas along the White River, Eagle Creek, Fall Creek, and Little Eagle Creek in Marion County. Of the 20 critical facilities, 14 are located in the City of Indianapolis and 6 in the Town of Speedway. These facilities do not include bridges and roadways that are in the floodway and floodplains throughout the County that could be damaged or destroyed by a levee failure.

Assuming that 25% of all critical and non-critical structures in the levee inundation zones would be destroyed, 35% would be 50% damaged, and 40% would have only 25% damage. A median replacement value, based on Marion County data, was determined for each occupancy class – residential commercial, industrial, government, education, and religious land uses. The damage to the structure, content, and land value of the 328 critical and non-critical facilities protected by levees on the White River is estimated to be \$46.9 million. Along Eagle Creek, the estimated damage is \$270 million (2,094 structures), \$19.7 million (144 structures) along Fall Creek, and

\$1.6 million (13 structures) along Little Eagle Creek. **Table 3-8** shows the estimated damage from levee loss combined with the estimated flood loss.

Table 3-8: Estimated Loss from Levee Failure

Waterway	Estimated Levee Failure Damage ¹
White River	\$46.9 M
Eagle Creek	\$270.0 M
Fall Creek	\$19.7 M
Little Eagle Creek	\$1.6 M

¹ Only along levees certified by FEMA with floodplain removed on FIRM. Additional damage is expected as a result of failure of “non-certified” levees.

Social losses are difficult to quantify, though interrupted services associated with critical facilities would cause hardship for many residents. It is too difficult to accurately estimate the potential social cost of a dam or levee failure due to the complexity of the hazard. It is probable, though, that a dam or levee failure would occur during extreme rainfall and flood events and would likely cause damage and disruption to community function, and possibly injury and death.

Dam & Levee Failure: Existing Mitigation Practices

Mitigation practices are projects, policies, or programs that reduce the social, physical, and economic impact of hazards. As part of this planning process, the Planning Committee discussed the strengths and weaknesses of existing mitigation practices and made recommendations for improvements as well as suggested new practices. The following is a summary of the mitigation practices discussed. A chart detailing all of the mitigation practices, hazards address, local priority, benefit-cost ratio, location, responsible entity, and funding can be found in Section 4.0 of this Plan.

The IDNR requires regular inspection and maintenance of all dams throughout the State, although the frequency of inspections depends on the individual dam’s hazard classification and condition. The storage of water is a potentially hazardous activity. Under Indiana law, the owner of a dam is responsible for operating and maintaining the dam in a safe manner to prevent harm to others and their property. Dam inspection includes formal technical inspections, maintenance inspections, informal inspections, and special inspections. The IDNR does not however require Emergency Action Plans (EAP) for high or significantly hazard dams. An EAP is a very good planning tool to understand the impact that a dam failure could have people and property downstream. These Plans include details about the volume and velocity of the water as well as accurate delineation of the dam inundation zone to allow timely evacuation of affected residents in potential dam failure emergency. Based on the significant loss predicted if one or more of the high hazards dams failed, a good mitigation practice would be to require EAPs for Eagle Creek Reservoir Dam, Geist Reservoir Dam, College Park Lake Dam, and Castlebrook Dam. Once these are complete, EAPs should be prepared for the significant hazard dams including Pogues Run, Warren Lake Dam, and Indian Lake Dam. EAPs should be required for all future high hazard and significant hazard dams in Marion County. The dam inundation zone delineated as part of the EAP could be used in conjunction with the Comprehensive Land Use Plan and Zoning Ordinance to prohibit future critical facilities downstream from a high or significant hazard dam.



The State does not require regular inspection and maintenance of the levees in Marion County. The City of Indianapolis does inspect the public levees following a significant rain event and did complete a comprehensive Levee Inspection Report in 2003. The 40 levees listed in this Report are only those that are entirely or partially publicly owned and the known private levees. Records of the location and condition of other private levees throughout the County do not exist. It is doubtful that these levees are inspected or maintained on a regular schedule. In an effort to

reduce the social, physical, and economic loss caused by a levee failure, it is critical that regular inspections of levees be conducted. To protect the critical and non-critical facilities landside of these levees, it is important that structural problems or deficiencies identified during inspection be quickly addressed. The 2003 Levee Inspection Report identified 7 levees that do not protect against a 100-year flood event, 6 levees in poor conditions, and 10 levees in fair condition. Addressing the deficiencies of these levees should become a priority. Enforcing a permitting process for construction of a private levee will ensure that the locations of these are at least documented. As resources become available, all of the NFIP communities in Marion County should begin document the location and condition of existing private levees.

Of the 40,517 buildings in Marion County that are located in the estimated dam and levee failure inundation zones, 311 are critical facilities (includes 20 critical facilities in levee inundation areas). Although the majority (92.5%) of these critical facilities are located in the City of Indianapolis, all of the NFIP communities in Marion County should secure funding to assist landowners with acquisition, relocation, elevation, and floodproofing of critical facilities in the estimated dam break inundation zones flood hazard areas. Due to their importance to the community, critical facilities, as well as access to them need to remain unaffected by rising floodwaters. All future critical facilities should be prohibited in the floodplains. Once these 311 critical facilities are protected from future flood damage from dam and levee failure, the NFIP communities should begin to acquire, relocate, elevate, and floodproof (non-residential only) the non-critical facilities located in the floodplain.

Due to the extensive damage they could cause, dams and levees could be intentionally breached or vandalized. Restricting access to dams to only authorized personnel and carefully monitoring changes in the levees through regular inspections and neighborhood watches are potential mitigation projects that could reduce or limit the social, economic, and physical impact of a dam or levee failure in Marion County.

Social, physical, and economic losses from dam failures will most likely increase as more people choose to live, work, and visit Marion County. Ensuring that residents and visitors are well informed about the potential impacts from a dam failure and proper methods to protect themselves and their property downstream of a high hazard dam will help reduce future losses and damage.

3.2.3 TORNADO & WINDSTORM

Tornados are defined as violently rotating columns of air extending from thunderstorms to the ground. Funnel clouds are rotating columns of air not in contact with the ground. However, a violently rotating column of air may reach the ground very quickly – becoming a tornado. If debris are lifted and blown around by a funnel cloud, then it has reached the ground and is considered a tornado event.

A tornado is generated when conditions in a strong thunderstorm cell are produced that exhibit a mass of cool air that overrides a layer of warm air, the underlying warm air is forced to rise rapidly and cool air to drop – sparking the swirling action. The damage associated with a tornado event is a result of the high wind velocity and wind-blown debris. In Indiana, tornado season occurs generally from April through June, although tornadoes can occur at any time of year. Tornadoes tend to occur in the afternoons and evenings, with over 80 percent of all tornadoes striking between 3 PM and 9 PM, but can occur at any time of day or night.



The majority of tornadoes (69%) have wind speeds of less than 100 miles per hour (mph), but the most violent tornadoes can produce wind speeds in excess of 205 mph. To gain an understanding of the energy produced by these violent tornadoes consider the following examples. In 1931, a tornado in Minnesota lifted an 83-ton railroad train with 117 passengers off the ground and carried it more than 80 feet. In another instance, a tornado in Oklahoma carried a motel sign 30 miles and dropped it in Arkansas. Finally, in 1975, a Mississippi tornado carried a home freezer more than a mile. Although these violent tornadoes (winds greater than 205 mph) account for only 2% of all tornadoes, they cause 70% of all tornado related deaths.

Although not as powerful as tornadoes, windstorms can cause great destruction and damage as well. Windstorms or high winds can result from thunderstorm inflow and outflow, downburst winds when storm clouds collapse, and from strong frontal systems, or gradient winds (high or low-pressure systems). Wind speeds are considered high when they reach 50 mph or greater, either sustaining or gusting.

Tornado & Windstorm: Historic Data

Tornadoes in Indiana generally come from the south through the west and move to the north through the east. In Marion County, the predominant tornado path seems to be from the southwest to the northeast, though there are instances where tornadoes have traveled from northwest to southeast. **Exhibit 7** illustrates the historical tornado activity in Marion County. According to the NCDRC, 38 tornadoes and 231 windstorms have been recorded in Marion County since January 1950. Significant windstorm events are characterized by top wind speeds achieved during the event. Tornadoes, on the other hand, are classified using the Fujita Scale of tornado intensity, as shown in **Table 3-9**. Tornado intensity ranges from low intensity (F0) tornadoes with effective wind speeds of 40-70 mph to high intensity (F5+) tornadoes with effective wind speeds of 261 to over 318 mph. Tornadoes recorded for Marion County include 7 - F0, 17 - F1, 6 - F2, 6 - F3, 1 - F4, and 1 tornado of an unknown magnitude. In addition, several

windstorms with magnitudes ranging from 57.5 mph to 100.1 mph have been recorded in Marion County.

Table 3-9: Fujita Scale of Tornado Intensity

F-Scale	Winds	Character of Damage	Relative Freq.
F0 (weak)	40-72 mph	light damage	29%
F1 (weak)	73-112 mph	moderate damage	40%
F2 (strong)	113-157 mph	considerable damage	24%
F3 (strong)	158-206 mph	severe damage	6%
F4 (violent)	207-260 mph	devastating damage	2%
F5 (violent)	261-318 mph	incredible damage	< 1%

Table 3-10 identifies all tornado events recorded in Marion County in which damage was reported to the NCDC. In total, more than 70 percent of the tornadoes recorded in Marion County have occurred between March and June.

Table 3-10: Historical Tornado Data

Location	Date	Magnitude	Death/Injury	Property Damage
Indianapolis	05/09/1952	F1	0/0	\$250 K
Indianapolis	06/13/1954	F1	0/0	\$3 K
Indianapolis	03/22/1955	F1	0/0	\$25 K
Indianapolis	11/15/1955	F2	0/2	\$25 K
Indianapolis	02/10/1959	F2	0/0	\$25 K
Indianapolis	04/16/1960	F	0/0	\$3 K
Indianapolis	04/22/1963	F3	0/20	\$2.5 M
Indianapolis	07/11/1966	F1	0/0	\$3 K
Indianapolis	08/09/1969	F3	0/6	\$250 K
Indianapolis	05/14/1970	F1	0/1	\$25 K
Indianapolis	05/14/1972	F4	0/17	\$250 K
Indianapolis	05/07/1973	F1	0/0	\$250 K
Indianapolis	05/19/1973	F1	0/0	\$25 K
Indianapolis	06/04/1973	F1	0/0	\$3,000
Indianapolis	07/04/1973	F1	0/0	\$2.5 M
Indianapolis	06/29/1976	F1	0/0	\$25 K
Indianapolis	07/26/1979	F0	0/0	\$3 K
Indianapolis	06/01/1980	F0	0/0	\$25 K

Location	Date	Magnitude	Death/Injury	Property Damage
Indianapolis	04/28/1981	F1	0/0	\$25 K
Indianapolis	05/27/1985	F1	0/2	\$25 K
Indianapolis	03/10/1986	F1	0/0	\$250 K
Indianapolis	03/10/1986	F3	0/10	\$2.5 M
Indianapolis	09/12/1988	F1	0/1	\$250 K
Indianapolis	08/20/1990	F0	0/0	\$25 K
Indianapolis	06/17/1992	F0	0/0	\$25 K
Indianapolis	11/22/1992	F3	0/0	\$2.5 M
Indianapolis	04/15/1994	F1	0/0	\$5 K
Indianapolis	05/14/1995	F2	0/0	\$400 K
Indianapolis	03/28/1997	F1	0/0	\$750 K
Indianapolis	06/11/1998	F3	0/3	\$1.5 M
Indianapolis/ Southport	09/20/2002	F2	0/97	\$40 M
Indianapolis	05/30/2004	F2	0/26	\$19 M
TOTALS			0/191	\$73.7 M

(NCDC, 2005)

According to the NCDC, the most significant tornado event to impact Marion County was an F2 event that occurred in September 2002. This event resulted in 97 injuries and over \$40 Million in damages. One of the longest tracking tornado paths in state history, the tornado originally touched down in Monroe County and remained on the ground for nearly 112 miles before finally lifting in Blackford County. Marion County accounted for approximately 18 miles of the tornado's 112 mile path.

The second most significant tornado to impact Marion County occurred on May 30, 2004. This tornado originally touched down on the south side of Indianapolis near the intersection of Harding Street and I-465 and cut a near continuous 18 mile path across the County before crossing into Hancock County a few miles south of the City of Lawrence. The heaviest damage was reported near South Keystone Avenue, between Raymond Street and Troy Avenue. In total, the tornado resulted in damage to nearly 600 homes, 24 apartment buildings, 90 commercial buildings, a nursing home, and an elementary school across Decatur, Perry, Center and Warren Townships in Marion County. Twenty-six nursing home inhabitants were treated at local hospitals for minor injuries and all of the nursing home's inhabitants were relocated as the building was severely damaged.

In addition to tornadoes, the NCDC has documented the occurrence of 238 windstorms in Marion County since 1955. These events have historically occurred year round with the greatest frequency and damage occurring in May, June, and July. These storms have resulted in 1 death 6 injuries and more than \$1.1 million dollars in property damages. An April 1994 windstorm accounted for nearly 50% of total damages associated with all 238 events combined.

Tables 3-11 identify the CPRI for a tornado or windstorm event for all NFIP communities in Marion County.

Table 3-11: Calculated Priority Risk Index for Tornado & Windstorm

	Probability <ul style="list-style-type: none"> • Unlikely • Possible • Likely • Highly likely 	Magnitude/Severity <ul style="list-style-type: none"> • Negligible • Limited • Critical • Catastrophic 	Warning Time <ul style="list-style-type: none"> • > 24 hrs • 12-24 hrs • 6-12 hrs • < 6 hrs 	Duration of Event <ul style="list-style-type: none"> • < 6 hrs • < 1 day • < 1 wk • > 1 wk 	CPRI
City of Indianapolis	Possible	Catastrophic	< 6 hours	< 6 hours	2.8
City of Beech Grove	Possible	Critical	< 6 hours	< 6 hours	2.5
City of Lawrence	Possible	Critical	< 6 hours	< 6 hours	2.5
City of Southport	Possible	Critical	< 6 hours	< 6 hours	2.5
Town of Speedway	Possible	Critical	< 6 hours	< 6 hours	2.5

According to the CPRI, the impact of a tornado or windstorm event is likely to be greater or more severe in the City of Indianapolis than it would be in other NFIP communities. This difference is primarily associated with the fact that the majority of critical facilities within Marion County are located within Indianapolis.

Tornado and Windstorm: Vulnerability Assessment

Given that the impacted areas associated with tornadoes and windstorms can vary greatly and considering the unpredictable nature of both hazards, all 1,015 critical facilities and 323,711 non-critical facilities located within Marion County are at risk of being impacted by tornado or windstorm event.

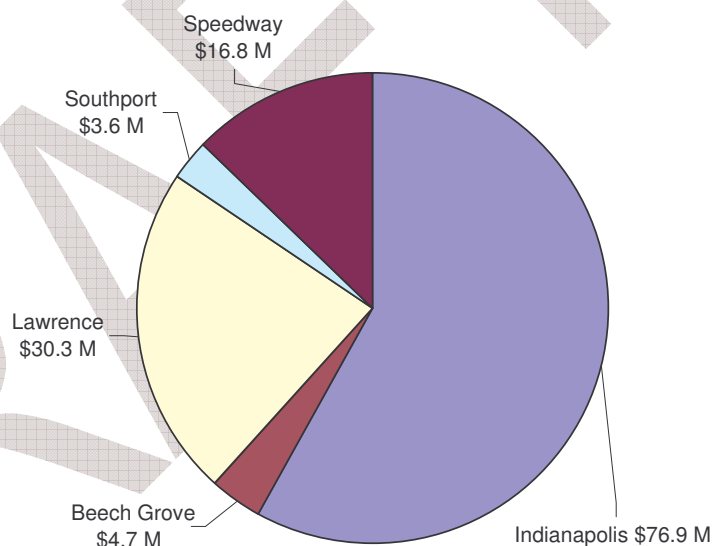
In an effort to evaluate the estimated economic impact that a tornado would have on participating NFIP communities, 5 hypothetical tornado scenarios were developed. The estimated economic damage associated with each hypothetical tornado event was derived by assuming that 25% of all critical and non-critical structures in the path of the tornado would be destroyed, 35% would be 50% damaged, and 40% would have only 25% damage. In each scenario, the average width of all tornadoes recorded in Marion County to date was used to determine the width of the hypothetical tornado's path. Finally, each estimated tornado path was overlaid on densely populated portions of the City of Indianapolis, the City of Beech Grove, the City of Lawrence, the City of Southport, and the Town of Speedway. **Table 3-12** identifies the number and type of structures impacted in each of the hypothetical scenarios.

Table 3-12: Structures Impacted by a Hypothetical Tornado Event

Building Type Damaged	Indianapolis	Lawrence	Beech Grove	Southport	Speedway
Residential	1,093	441	49	51	243
Commercial	49	9	4	0	11
Industrial	2	3	8	0	0
Government	0	2	0	0	0
Educational	3	2	3	0	0
Religious	4	1	2	2	0
TOTAL	1,151	458	66	53	254

Based on the estimated number of structures summarized in Table 3-12, the total economic impact potential as a result of tornado in Marion County is estimated to be \$132.3 million.

Figure 3-3 identifies the estimated economic impact predicted to occur because of the hypothetical tornado scenarios for each community. These damage estimates do not include costs associated with replacement of roads, utilities, or various other forms of infrastructure. Median Marion County structure values for each of the 6 building types were used to estimate economic impact associated with the hypothetical tornado scenarios. For each of the 6 building types listed in Table 3-10, the statistical range was quite broad. Therefore, the economic damages associated with these hypothetical scenarios could be substantially higher or lower depending on the actual value of the buildings and structures damaged.

Figure 3-3: Potential Tornado Impact

Tornado and Windstorm: Existing Mitigation Practices

Mitigation practices are projects, policies, or programs that reduce the social, physical, and economic impact of hazards. As part of this planning process, the Planning Committee discussed the strengths and weaknesses of existing mitigation practices and made recommendations for improvements as well as suggested new practices. The following is a summary of the mitigation practices discussed. A chart detailing all of the mitigation practices, hazards addressed, local priority, benefit-cost ratio, location, responsible entity, and funding can be found in Section 4.0 of this Plan.

The warning time associated with tornadoes and windstorms is very short and advanced warning systems, such as outdoor warning sirens in conjunction with the National Weather Services

Emergency Broadcast System (EBS) is an effective mitigation practice to reduce loss of life and property. In total, there are 144 outdoor warning sirens located in Marion County, Indiana. Of the critical facilities that would benefit from outdoor warning siren coverage (schools, emergency operation centers, law enforcement facilities, fire stations, medical care facilities, transportation facilities, and military installations), 52 are believed to be outside the audible range of outdoor warning sirens. Of these facilities, 5 are located within the City of Lawrence, and the remaining 47 are located within the City of Indianapolis.



Occupants of critical facilities not covered by outdoor warning sirens should stay abreast of current weather conditions through the utilization NOAA Weather Radios. This radio continuously broadcasts NWS forecasts, warnings, and other crucial weather information, is the primary trigger for activating the EBS on commercial radio, television, and cable systems, and can be purchased for under \$20. Many of the critical facilities located in Marion County currently own and operate NOAA weather radios however to reduce losses, they should be required in all critical facilities.

Easily identifiable safe rooms or community shelters may be necessary during a tornado or windstorm especially for structures without basements or sound interior rooms and in large public facilities. The location of safe rooms and shelters should be well advertised for both residents and visitors to Marion County. In addition, there is a definite need to provide new and existing mobile home parks with easily identifiable and centrally located safe rooms or community shelters. Public parks, sports complexes, and other common areas frequently used for public gatherings throughout Marion County should consider adding shelters that could provide citizens and visitors with protection from tornados or windstorms.

Much of the damage caused by tornados and windstorm is the result of fallen and broken limbs from trees. While even healthy trees may not be able to withstand 200 mph winds, maintaining trees in good condition in road right-of-ways and utility corridors and on public property will reduce the potential for dead or dying limbs to fall and damage people, property, or utility lines during a tornado or windstorm. Currently, Indianapolis Power and Light Company conducts regularly scheduled and as needed tree pruning and removal service to ensure safe and reliable electric service to Marion County residents.

As mentioned a tornado or windstorm could affect above ground utilities such as electricity or communication lines. To prevent a disruption of service, back-up power is essential at critical facilities especially medical care, police, fire, and community shelter facilities. Back-up generators would also be beneficial at all critical lift stations as well as major intersections throughout the County. In addition to back-up generators, a back-up fuel reserve is needed to ensure that back-up generators at critical facilities have the ability to continue functioning in event that power outages last beyond 12-24 hours. Although it is not a County-wide requirement, the majority of new developments occurring in Marion County are burying energy and communication lines. Although access to buried utility lines may be more difficult when the ground is frozen, they are less likely to be damaged by tornados or windstorms. The benefit

associated with burying all existing above ground utility lines does not outweigh the associated cost however; it does make sense for new development and redevelopment projects.

Social, physical, and economic losses from tornados and windstorms will most likely increase as more people choose to live, work, and visit Marion County. Ensuring that residents and visitors are well-informed about the potential impacts from a tornado or windstorm and proper methods to protect themselves and their property will help reduce future losses and damages associated with these events.

3.2.4 SEVERE WINTER STORM

A winter storm can range from moderate snow over a few hours to blizzard conditions with high winds, ice storms, freezing rain or sleet, heavy snowfall with blinding wind-driven snow, and extremely cold temperatures that can last for several days. Some winter storms may be large enough to affect several states while others may affect only a single community. All winter storms are accompanied by cold temperatures and blowing snow, which can severely reduce visibility. Winter storms are considered severe when they result in the accumulation of 4 or more inches of snow during a 12-hour period, or 6 or more inches during a 24-hour span. An ice storm occurs when freezing rain falls from clouds and freezes immediately on impact. All winter storms make driving and walking extremely hazardous. The aftermath of a winter storm can affect a community or region for days, weeks, and even months.



Storm effects such as extreme cold, flooding, and snow accumulation can cause hazardous conditions and hidden problems for people in the affected area. People can become stranded on the road or trapped at home, without utilities or other services. Residents, travelers, and livestock may become stranded without adequate food, water, and fuel supplies. The conditions may overwhelm the capabilities of a local jurisdiction. Winter storms are considered deceptive killers as they indirectly cause transportation accidents, and injury and death resulting from exhaustion/overexertion, hypothermia and frostbite from wind chill, and asphyxiation. Residential home fires also occur more frequently in the winter due to lack of proper safety precautions.

A winter storm watch indicates that severe winter weather may affect your area. A winter storm warning indicates that severe winter weather conditions are definitely on the way. A blizzard warning means that large amounts of falling or blowing snow and sustained winds of at least 35 miles-per-hour are expected for several hours. Severe winter storms include freezing rain, sleet, heavy snow, blizzards, icy conditions, extreme low temperatures, and strong winds are common during the winter months in Marion County. Such conditions can result in substantial personal and property damage, even death.

Severe Winter Storm: Historic Data

Numerous severe winter storms have been recorded in Marion County. The NCDC has recorded 12 winter storms, 5 heavy snow, and 1 snow storm events since October 1993. The

Hazard Analysis prepared for the Marion County CEMP included 2 additional severe winter storms. In January 1978, Marion County's most severe snowstorm brought approximately 20 inches of snow to the Indianapolis Metropolitan Area. Rapid wind gusts topping 55 mph caused 10 -20 foot snow drifts throughout the County and dropped wind chill temperatures to as low as 50 degrees below zero.

A second major event occurred on New Years Day 2000 when a severe winter storm brought heavy snow to all but the southern most portions of Marion County. The storm resulted in approximately 6 inches of snow and 2-3 inches of ice. Rapid winds and freezing rain made highway and interstate travel nearly impossible. Finally, in December 2004, severe winter storm conditions brought heavy snow to central and south-central Indiana, and resulted in a Federal Disaster Declaration. The 2004 storm event has been linked to three deaths and approximately \$3.0 million in statewide damage. It is not clear to what extent the economic impact and loss of life occurred within Marion County. **Table 3-13** identifies the CPRI for a severe winter storm event for all NFIP communities in Marion County.

Table 3-13: Calculated Priority Risk Index for Severe Winter Storm

	Probability <ul style="list-style-type: none"> • Unlikely • Possible • Likely • Highly likely 	Magnitude/Severity <ul style="list-style-type: none"> • Negligible • Limited • Critical • Catastrophic 	Warning Time <ul style="list-style-type: none"> • > 24 hrs • 12-24 hrs • 6-12 hrs • < 6 hrs 	Duration of Event <ul style="list-style-type: none"> • < 6 hrs • < 1 day • < 1 wk • > 1 wk 	CPRI
City of Indianapolis	Likely	Limited	> 24 hours	< 1 week	2.4
City of Beech Grove	Likely	Limited	> 24 hours	< 1 week	2.4
City of Lawrence	Likely	Limited	> 24 hours	< 1 week	2.4
City of Southport	Likely	Limited	> 24 hours	< 1 week	2.4
Town of Speedway	Likely	Limited	> 24 hours	< 1 week	2.4

As shown by the CPRI, the type, severity, warning time, and duration for severe winter storm events are the same for all communities in Marion County due to the regional extent and diffuse severity of this hazard event.

Severe Winter Storm: Vulnerability Assessment

A severe winter storm typically affects a large regional area with potential for physical, economic, and/or social losses. Given the nature and complexity of a regional hazard event such as a severe winter storm, it is difficult to quantify potential losses to property and infrastructure. Unfortunately, only one severe winter storm, December 22, 2004, as recorded by the NCDRC has losses associated with it (3 injuries and \$3.0 million in property damage). Based on this event, Marion County communities should expect similar losses as well as significant disruption to all community functions, and should anticipate that all functions will be affected simultaneously. Thus, mitigation measures should consider that the extent and severity of this hazard could render many, and possibly all, facilities non-functional during a severe winter storm event.

Around the nation, severe winter storms have resulted in substantial physical, social and economic damages. For example, a March 2003 snowstorm in Denver, Colorado dropped

approximately 31 inches of snow and caused an estimated \$34 Million in total damages. In addition, a February 2003 winter storm dropped an estimated 15 - 20 inches of snow in parts of Ohio. The Ohio and Federal Emergency Management Agencies and U.S. Small Business Administration surveyed damaged areas and issued a preliminary assessment of \$17 million in disaster related costs. These costs included snow and debris removal, emergency loss prevention measures, and public utilities repair. The agencies found over 300 homes and businesses either damaged or destroyed in six counties.

While the above examples indicated the wide-ranging and large-scale impact that severe winter storms can have on a community or region, in general, severe winter storms tend to result in less direct economic impacts than many other natural hazards. According to the *Workshop on the Social and Economic Impacts of Weather*, which was sponsored by the U.S. Weather Research Program, the American Meteorological Society, the White House Subcommittee on Natural Disaster Relief, and others, severe winter storms resulted in an average of 47 deaths and more than \$1 Billion in economic losses per year between 1988 and 1995. However, these totals account for only 3% of the total weather-related economic loss and only 9% of fatalities associated with all weather related hazards over the same time period.

However, severe winter storms can also result in substantial indirect costs. According to a report by the National Center for Environmental Predictions, cold and snowy winter in late 1977 and early 1978, which impacted several heavily populated regions of the country, was partially responsible for reducing the nations Gross Domestic Product (GDP) from an estimated growth rate of between 6% and 7% during the first three quarters of 1977 to approximately -1% in the last quarter of 1977 and 3% during the first quarter of 1978.

Severe Winter Storm: Existing Mitigation Practices

Mitigation practices are projects, policies, or programs that reduce the social, physical, and economic impact of hazards. As part of this planning process, the Planning Committee discussed the strengths and weaknesses of existing mitigation practices and made recommendations for improvements as well as suggested new practices. The following is a summary of the mitigation practices discussed. A chart detailing all of the mitigation practices, hazards address, local priority, benefit-cost ratio, location, responsible entity, and funding can be found in Section 4.0 of this Plan.

The probability of at least one severe winter storm occurring in Marion County per year is likely. Fortunately, the warning time associated with severe winter storms is more than 24 hours, which should give residents, business owners, and visitors adequate time to protect themselves and their property. Residents and businesses, especially critical facilities, should stay abreast of current weather conditions with NOAA Weather Radio. This radio continuously broadcasts NWS forecasts, warnings, and other crucial weather information and is the primary trigger for activating the Emergency Broadcast System (EBS) on commercial radio, television, and cable systems. Many of the critical facilities in Marion County currently own and operate NOAA weather radios however to reduce losses, they should be required in all critical facilities.

It is unlikely that safe rooms or community shelters would be necessary during a severe winter storm however if needed, the location of these facilities should be well advertised for both residents and visitors to Marion County. The Red Cross of Greater Indianapolis currently has agreements with schools and churches throughout the County for both temporary and long-term shelter. Safe rooms or community shelters should also be incorporated into all new public facilities since these facilities are typically centrally located, are accessible for all levels of

mobility, and are regularly occupied by a large percentage of the population that may need to seek shelter.

A severe winter storm, especially with heavy snow or ice, could affect above ground utilities such as electricity or communication lines. To prevent a disruption of service, back-up power is essential at critical facilities especially medical care, police, fire, and community shelter facilities. Back-up generators would also be beneficial at all critical lift stations as well as major intersections throughout the County. In addition to back-up generators, a back-up fuel reserve is needed to ensure that back-up generators at critical facilities have the ability to continue functioning in event that power outages last beyond 12-24 hours. Although it is not a County-wide requirement, the majority of new developments occurring in Marion County are burying energy and communication lines.. Although access to buried utility lines may be more difficult when the ground is frozen, they are less likely to be damaged by a severe winter storm. The benefit associated with burying all existing above ground utility lines does not outweigh the associated cost however; it does make sense for new development and redevelopment projects.

Severe winter storms will stretch the resources of local Public Works, Street Departments, and emergency response agencies. During periods of severe winter storms employees often work long shifts in dangerous conditions. Therefore, in order to ensure the safety of the employees of these agencies and to improve tracking of plowed areas, Global Positioning Systems (GPS) should be added to municipal owned snowplows and critical vehicles operated by these agencies should be equipped with mobile data terminals.

Social, physical, and economic losses associated with severe winter storms will likely increase as more people choose to live, work, and visit Marion County. Ensuring that residents and visitors are well informed about the potential impacts from severe winter storms and the proper methods to protect themselves and their property will help reduce future losses and damages.

3.2.5 CIVIL DISTURBANCES

Civil disturbances typically occur when highly visible and large-scale public events result in rioting, looting, arson, disruption of essential services and functions, or other unlawful behavior. These disturbances typically occur in association with events and activities with strong public interest and attention. Historically within the United States, civil disturbances have occurred frequently and have had a wide range of physical, social, and economic impacts.

Civil Disturbance: Historic Data

There are numerous events conducted in Marion County that could potentially result in civil disturbances. **Table 3-14** lists facilities and events that frequently attract high public scrutiny and media attention within Marion County.

Table 3-14: Facilities and Events with Potential for Civil Disturbance

Event/Facility	Description	NFIP Community
RCA Dome/Convention Center	The RCA Dome and Convention Center hold approximately 320 annual events, and attendance ranges from 30-50,000.	City of Indianapolis
Conseco Fieldhouse	Conseco is home to Indiana Pacers and Fever and numerous other events and	City of Indianapolis

Event/Facility	Description	NFIP Community
	holds approximately 18,345 spectators.	
Indianapolis Motor Speedway (IMS)	Combined attendance at the three major races held at the IMS every year is typically greater than 750,000	Town of Speedway
Hinkle Fieldhouse	Hinkle holds approximately 15,000 spectators and is located on the campus of Butler University.	City of Indianapolis
State Fair Grounds	The Indiana State Fair draws more than 800,000 visitors annually, the Pepsi Coliseum holds approximately 8,000 spectators, and there are numerous other events held on the State Fair Grounds throughout the year.	City of Indianapolis
Black Expo	Annual attendance is greater than 60,000.	City of Indianapolis
Indianapolis Zoo	There are approximately 1.2 million visitors to the zoo each year. Typical summer attendance is between 5,000 and 6,000 per day.	City of Indianapolis
Mini Marathon	The Mini Marathon draws more than 30,000 participants and 4,000 volunteers to downtown Indianapolis annually.	City of Indianapolis and Town of Speedway
Circle City Classic	The Circle City Classic draws approximately 175,000 visitors to downtown Indianapolis annually.	City of Indianapolis
Government Buildings	Polarizing political and judicial decisions occur daily.	All NFIP Communities

Despite the frequent number of large-scale events that occur in Marion County every year, historically there have been relatively few civil disturbances. According to the 2004 Marion County Comprehensive Hazard Analysis, there have been 5 significant civil disturbance events since 1975.

In 1975, the Speedway Police Department was forced to use tear gas to quell a disturbance among an estimated 2,000 spectators at the Indianapolis Motor Speedway. The disturbance broke out when police tried to arrest an intoxicated spectator in the first turn of the infield. The second civil disturbance event occurred in 1988, when 39 protesters were arrested in Indianapolis after blocking access to an abortion clinic.



The third event of record occurred on several separate occasions between 1993 and 1995, when the Ku Klux Klan held rallies at the Indiana State Capital. The fourth event, which

occurred in 1999, was also associated with elevated racial tensions. This event resulted in 150 residents taking to the streets in Indianapolis near the intersection of 42nd Street and College Avenue. This disturbance lasted approximately three days and resulted in 2 injuries. Before order was restored, rioters threw rocks, bottles, and bricks at police, and over the course of three days, 15 police vehicles were damaged, several area businesses were looted, and numerous private residences were damaged.

The fifth and final disturbance of record occurred in August 2003, when the National Governors Association held a conference in downtown Indianapolis. The conference resulted in hundreds of protestors gathering to voice their beliefs. The Indianapolis Police Department and Indiana State Police joined efforts to control the event. **Table 3-15** identifies the CPRI for civil disturbance events for all NFIP communities in Marion County.

Table 3-15: Calculated Priority Risk Index for Civil Disturbance

	Probability <ul style="list-style-type: none"> • Unlikely • Possible • Likely • Highly likely 	Magnitude/Severity <ul style="list-style-type: none"> • Negligible • Limited • Critical • Catastrophic 	Warning Time <ul style="list-style-type: none"> • > 24 hrs • 12-24 hrs • 6-12 hrs • < 6 hrs 	Duration of Event <ul style="list-style-type: none"> • < 6 hrs • < 1 day • < 1 wk • > 1 wk 	CPRI
City of Indianapolis	Possible	Limited	< 6 hours	< 1 day	2.3
City of Beech Grove	Unlikely	Negligible	> 24 hours	< 6 hours	1.0
City of Lawrence	Unlikely	Negligible	> 24 hours	< 6 hours	1.0
City of Southport	Unlikely	Negligible	> 24 hours	< 6 hours	1.0
Town of Speedway	Possible	Limited	< 6 hours	< 1 day	2.3

Given the large size, strong public interest, and regular frequency associated with events occurring within the City of Indianapolis and the Town of Speedway, it was determined that civil disturbances are more likely to occur in these communities.

Civil Disturbance: Vulnerability Assessment

Civil disturbances can have a variety of physical, social, and economic impacts to a community, and while certain facilities and events are more likely than others to be the site of civil disturbances, these disturbances can occur in almost any location. In addition, the very nature of these events makes predicting the extent of their damage very difficult. A small-scale disturbance, such as a local labor strike might have a minor community impact, and would likely require only minimal police oversight or management. Another slightly larger disturbance might be associated with a protest growing large enough to begin disrupting businesses or traffic patterns, in this situation police intervention might require active control, but would not likely require the use of chemical agents or riot gear. On the other hand, civil disturbances could potentially grow large enough and violent enough that rioting, looting, arson, and other violent acts might occur. These larger disturbances usually require the use of chemicals, riot gear, and large-scale arrests in order to restore order. Given the unpredictable nature of civil disturbances, an estimate of potential losses associated with a disturbance was not estimated.

However, other communities around the nation have been impacted by civil disturbances, which have resulted in widespread economic and social losses. In 1992, the Rodney King trial

resulted in wide spread looting and rioting in Los Angeles, California. The 1992 riots resulted in 52 deaths, 2,500 injuries and more than \$446 Million in property damages. In addition, one study estimates that the riots have resulted in more than \$125 Million in loss sales tax revenues.

Another large-scale civil disturbance occurred in Seattle in 1999, where the World Trade Organization's (WTO) conference resulted in massive demonstrations and thousands of protesters overwhelming Seattle police in the downtown area. Police were eventually forced to use tear gas, pepper spray, and implement curfews in order to control protesters. Once the massive crowd was controlled more than 500 people were arrested, numerous injuries were reported, and downtown businesses claimed more than \$20 million in lost sales and property damages.

The losses associated with the Los Angeles and Seattle events are not typical, however they are indicative of the wide spread social and economic loss that can potentially result from large-scale civil disturbances.

Civil Disturbance: Existing Mitigation Practices

Mitigation practices are projects, policies, or programs that reduce the social, physical, and economic impact of hazards. As part of this planning process, the Planning Committee discussed the strengths and weaknesses of existing mitigation practices and made recommendations for improvements as well as suggested new practices. The following is a summary of the mitigation practices discussed. A chart detailing all of the mitigation practices, hazards addressed, local priority, benefit-cost ratio, location, responsible entity, and funding can be found in Section 4.0 of this Plan.

Fortunately, most large facilities such as the RCA Dome, Conseco Fieldhouse, IMS, and Simon Malls already have emergency plans in place that would help to minimize potential impact associated with the occurrence of a civil disturbance at one of these facilities. For example, the IMS has a Plan 500, Plan 400, and Plan Grand Prix, which outlines emergency response and recovery plans for each of the three major races that occur at the IMS every year. Given the similarities between these large facilities, both in terms of crowd density and the probability for a civil disturbance to occur, the management and emergency personnel from these facilities should attempt to improve emergency planning and coordination with local emergency response teams through the existing Event Advisory Board.

In addition, permanent video monitoring systems, such as the existing systems located near Monument Circle, should be installed where large crowds are anticipated to occur. Local law enforcement agencies should also purchase new mobile video monitoring systems, which would allow them to gain valuable video footage of civil disturbances occurring within Marion County. Resulting video footage would help facilitate post-disturbance prosecution and would prove useful in training new law enforcement and emergency response officials in civil disturbance response.

Social, physical, and economic losses associated civil disturbances will likely increase as more people choose to live, work, and visit Marion County. Ensuring that residents and visitors are well informed about the potential impacts and threats associated with civil disturbances and the proper methods to protect themselves and their property will help reduce future losses and damages.

3.2.6 HAILSTORM

Hail occurs when frozen water droplets form inside a thunderstorm cloud, then grow into ice formations held aloft by powerful thunderstorm updrafts, and when the weight of the ice formations becomes too heavy they fall as hail to the ground. These droplets form during strong updrafts of warm air and downdrafts of cold air, when the water droplets are carried well above the freezing level to temperatures below 32°F, and then the frozen droplet begins to fall, carried by cold downdrafts, and may begin to thaw as it moves into warmer air toward the bottom of the thunderstorm. This movement up and down inside the cloud, through cold then warmer temperatures, causes the droplet to add layers of ice and can become quite large, sometimes round or oval shaped and sometimes irregularly shaped, before it finally falls to the ground as hail. Typical hail size ranges from smaller than a pea to as large as a softball, and can be very destructive to buildings, vehicles, and crops. Even small hail can cause significant damage to young and tender plants. Residents should take cover immediately in a hailstorm, and protect pets and livestock, which are particularly vulnerable to hail, and should be under shelter as well.

Hailstorm: Historic Data

According to the NCDC, there have been 125 hailstorms reported in Marion County since January 1950. The largest reported size was 3" hail in June 1965. Hailstorms appear to be most frequent during the months of April, May, July, and August. Undoubtedly, property and crop damage have occurred because of these events, however no damage estimates associated with hailstorms have been reported to the NCDC. **Table 3-16** identifies the CPRI for a hailstorm event for all NFIP communities in Marion County.



Table 3-16: Calculated Priority Risk Index for Hailstorm

	Probability <ul style="list-style-type: none"> • Unlikely • Possible • Likely • Highly likely 	Magnitude/Severity <ul style="list-style-type: none"> • Negligible • Limited • Critical • Catastrophic 	Warning Time <ul style="list-style-type: none"> • > 24 hrs • 12-24 hrs • 6-12 hrs • < 6 hrs 	Duration of Event <ul style="list-style-type: none"> • < 6 hrs • < 1 day • < 1 wk • > 1 wk 	CPRI
City of Indianapolis	Possible	Limited	< 6 hours	< 6 hours	2.2
City of Beech Grove	Possible	Limited	< 6 hours	< 6 hours	2.2
City of Lawrence	Possible	Limited	< 6 hours	< 6 hours	2.2
City of Southport	Possible	Limited	< 6 hours	< 6 hours	2.2
Town of Speedway	Possible	Limited	< 6 hours	< 6 hours	2.2

There is no significant difference in CPRI values among NFIP communities due to the arbitrary nature of hailstorm occurrence and severity over the entire region.

Hailstorm: Vulnerability Assessment

Assets vulnerable to hailstorms include structures, crops/livestock, and property stored outdoors. Typically, hail is not a direct threat to human safety; however, hailstorm events can lead to automobile accidents, utility failure, and other infrastructure impacts that could indirectly be a threat to human safety. Large hailstones can fall at speeds faster than 100 mph and can cause significant damaged to property. In fact, since 1990, hailstorms have resulted in the following damages in other similarly sized communities around the nation.

- Denver, Colorado (Pop. 550,000) – July 1990 event resulted in \$650 Million in damages
- Oakland, California (Pop. 400,000) – April 1992 event resulted in \$85 Million in damages
- Oklahoma City, Oklahoma (Pop. 506,000) – April 1992 event resulted in \$200 Million in damages
- Wichita, Kansas (Pop. 344,000) – June 1992 event resulted in \$215 Million in damages
- Dallas, Texas (Pop. 1.2 million) – April 1995 event resulted in \$227 Million damages
- Fort Worth, Texas (Pop. 535,000) – May 1995 event resulted in \$300 Million in damages

Given the unpredictable and regional nature of hailstorms and that historic loss are not readily available the physical, social, and economic damages associated with a hailstorm were not estimated for Marion County. However, the impacts associated with the hailstorm events listed above are indicative of the economic loss that could potentially result from a large hailstorm occurring in Marion County. In order to better assess community vulnerability, future property and crop damage caused by hailstorms should be carefully recorded

Hailstorm: Existing Mitigation Practices

Mitigation practices are projects, policies, or programs that reduce the social, physical, and economic impact of hazards. As part of this planning process, the Planning Committee discussed the strengths and weaknesses of existing mitigation practices and made recommendations for improvements as well as suggested new practices. The following is a summary of the mitigation practices discussed. A chart detailing all of the mitigation practices, hazards addressed, local priority, benefit-cost ratio, location, responsible entity, and funding can be found in Section 4.0 of this Plan.

While hailstorms in Marion County are possible, there are few mitigation practices that specifically address the impacts associated with hailstorms. Since hailstorms have a very short warning time, residents and businesses, especially critical facilities, should stay abreast of current weather conditions with NOAA Weather Radio. This radio continuously broadcasts NWS forecasts, warnings, and other crucial weather information and is the primary trigger for activating the Emergency Broadcast System (EBS) on commercial radio, television, and cable systems. Many of the critical facilities in Marion County currently own and operate NOAA weather radios however to reduce losses, they should be required in all critical facilities.

It is unlikely that safe rooms or community shelters would be necessary during a hailstorm however if needed, the location of these facilities should be well advertised for both residents and visitors to Marion County. Safe rooms should be incorporated into all new public facilities since these facilities are typically centrally located, are accessible for all levels of mobility, and regularly occupied by a large percentage of the population that may need to seek shelter. Public parks, sports complexes, and other common areas frequently used for public gatherings in the County are also in need of shelters that could provide citizens and visitors with protection from severe weather.

Social, physical, and economic losses from hailstorms will most likely increase as more people choose to live, work, and visit Marion County. Ensuring that residents and visitors are well informed about the potential impacts from hailstorms and proper methods to protect themselves and their property will help reduce future losses and damage.

3.2.7 HAZARDOUS MATERIAL

Hazardous materials come in the form of flammable, explosive, corrosive, and toxic materials. Nation-wide the most common releases of hazardous materials are associated with transportation accidents or chemical accidents at various plants. Hazardous materials can result in death, injury, property damage and long lasting environmental impacts. Emergency response associated with hazardous materials may require fire, safety/law enforcement, search and rescue, and hazardous materials response teams.

Within Marion County, the Indianapolis Fire Department (IFD) categorizes Hazardous Materials incidents into 4 distinct levels of significance. A Level I incident is characterized as an incident that results in a spill, leak, rupture, or fire involving hazardous materials that can be contained, extinguished, and or abated utilizing equipment, supplies, and resources immediately available to the jurisdictional fire department's first responders; and or when evacuation of civilians is not required.



A Level II incident is characterized as an event in which the hazardous material can only be identified, tested, sampled, contained, extinguished or abated utilizing the equipment, supplies, or resources of the jurisdictional fire department or mutual aid Hazardous Materials Response Team (HMRT) and other support agencies. An incident is also considered a Level II event when the use of chemical gear, specialized equipment, and limited decontamination are required.

Level III incidents involve materials that can only be identified, tested, sampled, contained, extinguished, or abated utilizing equipment, supplies, and resources from the jurisdictional fire department or mutual aid HMRT and other support agencies: when the use of protective gear, specialized equipment and limited decontamination are required; when the incident requires assistance from 1 additional HMRT or extensive decontamination of civilians or personnel; when several mobile decontamination units are required on scene, when the evacuation of civilians within the areas is needed, when spills, leaks, or ruptures require control utilizing special equipment and response personnel available to a specific HMRT; when fires are allowed to burn due to ineffective use or dangers related to the use of extinguishing agents or lack of water supplies; when there is a threat of a large container failure, or when there has been an explosion, detonation, or container failure.

A Level IV incident requires extensive assistance from multiple HMRTs of the Marion County Hazardous Materials Task Force; when incidents necessitate multi-agency involvement of large proportions for extensive evacuations of civilians extending across jurisdictional boundaries; when significant civilian injuries or deaths have resulted; when specialized equipment, supplies,

and response personnel are needed to control or abate incidents involving fires, spills, leaks, or ruptures.

Hazardous Material: Historic Data

Three significant hazardous materials related events have occurred in Marion County since 1994. These events include the Central Soya Hexan gas explosion in 1996 that injured 11 people, the Metal Working Lubricants chemical fire in 1996 that resulted in \$1 million in damage and the evacuation of 100 residences, and the chemical fire of 1996 that resulted in the evacuation of the surrounding area and approximately \$850,000 in damage.

According to IDEM's Hazardous Waste Notifiers List, there are 2,213 hazardous waste handlers within Marion County. Nine hundred and fifty-one of those facilities are considered active generators, of which 937 are located within the City of Indianapolis, 8 are located in the City of Beech Grove, 4 are located in the Town of Speedway, and 2 are located in the City of Lawrence. Seventy-three facilities are considered active transporters of hazardous materials and all of those facilities are located in the City of Indianapolis. Another, six facilities are considered active hazardous materials treatment, storage, and disposal facilities.

In addition, there are 1,173 leaking underground storage tanks located in Marion County that are classified as active. Of those, 1,151 are located in the City of Indianapolis, 10 are located in the City of Beech Grove, 8 are located in the Town of Speedway, and 4 are located in the City of Lawrence. Alternatively, there are 1,428 underground storage tanks currently in use in Marion County. One thousand three hundred and ninety of those facilities are located in the City of Indianapolis, 22 are located in the City of Lawrence, 12 are located in the Town of Speedway, and 4 are located in the City of Southport.

In 1986, the federal government passed the Emergency Planning Community Right to Know Act (EMCRA), also known as the Superfund Amendment and Reauthorization Act (SARA), which required federal, state, and local governments and industries to begin emergency planning and reporting on hazardous and toxic chemicals. Any facility storing greater than 10,000 lbs of hazardous chemicals and any facility storing more than 500 lbs of an Extremely Hazardous Substance (EHS) is required to submit a Tier II emergency and hazardous chemical inventory form to their Local Emergency Plan Commission (LEPC). In Marion County, there are typically between 400 and 450 Tier II facilities and 170 – 180 EHS facilities.

In 1990, Congress enacted a compliment to EPCRA, known as the Risk Management Program (RMP), which is found under Section 112(r) of the Clean Air Act (CAA). This program makes information available to the public on how accidental releases of hazardous chemical could affect communities. While EPCRA focuses on response once an emergency occurs, the RMP focuses on facility planning before an emergency occurs. The RMP seeks to reduce the risk of airborne chemical accidents by instituting measures to prevent hazardous chemical releases. The RMP addresses the management of 77 acutely toxic chemicals and 63 flammable gasses and volatile liquids. According to the regulation, any facility producing, processing, handling, or storing these substances in amounts above threshold quantities is required to develop and implement a RMP. The RMP must include a hazard assessment as it relates to the release of a regulated substance, which includes off site consequences, programs to prevent accidental losses, emergency action in response to accidental releases, and communication with federal, state, and local governments and the public. There are 27 facilities in Marion County regulated under Section 112(r) of the CAA.

In addition to these facilities, there are a total of six Interstate Highways (I-65, I-69, I-70, I-74, I-465, and I-865), eight state highways, and five railroads located in Marion County that are routinely used for hazardous materials transport. The Indianapolis International Airport is the third busiest cargo hub in the nation and handles approximately 7.3 million passengers and 719 takeoffs and landings per day. Finally, there are numerous major pipelines in the County, which are operated by Amoco Pipeline, Buckeye Pipeline, Marathon Ashland, Panhandle Eastern, Shell Oil Products, and Texas Eastern Products.

According to FEMA, between 1991, there were nearly 50,999 transportation related hazardous materials incidents nationally. **Table 3-17**, identifies hazardous materials incidents in the United States by mode of transportation between 1983 and 1990. **Table 3-18** identifies the Calculated Priority Risk Index (CPRI) for a hazardous materials event for all NFIP communities in Marion County.

Table 3-17: Hazardous Materials Incidents by Transportation Mode

Transportation Mode	Number of Accidents	Associated Deaths	Associated Injuries
Air	1,220	0	153
Highway	41,781	79	1,569
Railway	7,886	1	423
Water	83	1	35
Other	29	0	2
TOTAL	50,999	81	2,182

Table 3-18: Calculated Priority Risk Index for Hazardous Material

	Probability <ul style="list-style-type: none"> • Unlikely • Possible • Likely • Highly likely 	Magnitude/Severity <ul style="list-style-type: none"> • Negligible • Limited • Critical • Catastrophic 	Warning Time <ul style="list-style-type: none"> • > 24 hrs • 12-24 hrs • 6-12 hrs • < 6 hrs 	Duration of Event <ul style="list-style-type: none"> • < 6 hrs • < 1 day • < 1 wk • > 1 wk 	CPRI
City of Indianapolis	Possible	Limited	< 6 hours	< 6 hours	2.2
City of Beech Grove	Possible	Limited	< 6 hours	< 6 hours	2.2
City of Lawrence	Possible	Negligible	< 6 hours	< 6 hours	1.9
City of Southport	Possible	Negligible	< 6 hours	< 6 hours	1.9
Town of Speedway	Possible	Limited	< 6 hours	< 6 hours	2.2

Based on the CPRI, a hazardous materials event is possible for all Marion County communities. The magnitude or severity of a hazardous materials incident was anticipated to be smaller in communities with fewer transportation corridors and facilities that handle hazardous materials.

Hazardous Material: Vulnerability Assessment

Predicting potential losses associated with hazardous materials incidents is subjective and difficult. However, based on a study conducted by the Federal Motor Carrier Safety Administration, the average cost per year per hazardous material transportation accident and incident that results in the release of a hazardous material is \$536,000. When hazardous material accidents and incidents result in fire, the average cost per event increases to \$1.2 million, and when the accident or incident results in an explosion, the cost per event increases to \$2.1 million. These costs are indicative of the economic impact that can result from hazardous materials accidents and incidents in Marion County.

In an effort to estimate potential impacts and costs associated with hazardous material incidents, the 27 facilities regulated under Section 112(r) of the CAA were mapped and all structures located within a half-mile or one-mile radius of these facilities were identified. One Section 112(r) facility is in the City of Lawrence, 4 within the Town of Speedway, and 22 in the City of Indianapolis. **Table 3-19** identifies the number and estimated value of structures located within a half-mile or one-mile radius of the County's 27 112(r) facilities.

Table 3-19: Structures Located Within a Half-Mile or Mile Radius of 112(r) Facilities

Occupancy Class	Half-Mile Radius of 112(r) Facilities		One-Mile Radius of 112(r) Facilities	
	Number of Structures	Estimated Value	Number of Structures	Estimated Value
Residential	10,282	\$1.28B	46,232	\$5.76 B
Commercial	1,062	\$181M	3,741	\$637 M
Industrial	1,462	\$195M	3,230	\$430 M
Governmental	41	\$3.03M	129	\$9.6 M
Education	26	\$5.08M	162	\$31.6 M
Religious	41	\$12.4M	190	\$57.5 M
TOTALS	12,914	\$1.68B	53,684	\$6.93 B

Seventy-five structures in the half-mile radius and 223 structures in the one-mile radius of 112(r) facilities are critical facilities. The estimated value or loss for structures (including land improvement value and structure content) in the half-mile and one mile radius of 112(r) facilities is estimated to be \$1.7 billion and \$6.9 billion respectively. This simple analysis assumes that these structures would be destroyed or left inhabitable.

Hazardous Material: Existing Mitigation

Mitigation practices are projects, policies, or programs that reduce the social, physical, and economic impact of hazards. As part of this planning process, the Planning Committee discussed the strengths and weaknesses of existing mitigation practices and made recommendations for improvements as well as suggested new practices. The following is a summary of the mitigation practices discussed. A chart detailing all of the mitigation practices, hazards addressed, local priority, benefit-cost ratio, location, responsible entity, and funding can be found in Section 4.0 of this Plan.

It is possible that a future hazardous materials incident could affect all NFIP communities. In 1986, Title III of SARA established local hazardous material emergency planning, reporting and training requirements. The Marion County Local Emergency Planning Committee is the primary mechanism through which Sara Title III planning, training, and exercise activities occur in the County.

The City of Indianapolis has a hazardous materials ordinance, which restricts hazardous materials carriers that do not originate or terminate in Marion County to Interstate I-465 for travel. Certain portions of downtown Indianapolis are also designated as hazardous material routes as well. In order to minimize potential exposure to hazardous materials incidents, these existing transportation routes should be enforced.

In recognition of the risks associated with hazardous materials, the Indianapolis Fire Department, the Indianapolis International Airport Fire Department, the Pike, Warren, Washington, and Wayne Township Fire Departments, the Indianapolis Police Department, the Indianapolis DPW, the Marion County Health Department, and the Marion County Emergency Management Department participate in the Marion County Hazardous Materials Task Force. The mission of the Task Force is to provide high quality, comprehensive emergency hazmat response training to meet current standards and produce safe knowledgeable emergency responders.

Depending on the significance of the hazardous material incident, safe havens and community shelters may be needed to provide evacuated residents with temporary shelter. The location of these facilities should be well advertised for both residents and visitors to Marion County. The Red Cross of Greater Indianapolis currently has agreements with schools and churches throughout the County for both temporary and long-term shelter.

Social, physical, and economic losses from hazardous materials incidents will most likely increase as more people choose to live, work, and visit Marion County. Ensuring that residents and visitors are well informed about the potential impacts from hazardous materials and proper methods to protect themselves and their property will help reduce future losses and damage.

3.2.8 DROUGHT



Drought, in general, means a moisture deficit bad enough to have social, environmental, or economic effects. There are varied definitions of drought and it may be considered in two ways; a conceptual definition, or an operational definition. The conceptual definition describes the climate phenomenon in terms that are general and with clear impacts to the community. For example, drought is a protracted period of deficient precipitation resulting in extensive damage to crops and resulting in loss of yield. On the other hand, an operational definition defines a drought in terms of its beginning, end, and magnitude or

severity. For example, the deficiency in rainfall or moisture conditions could be compared to the long-term average for a region and identified as outside the range of typical climate pattern.

Both definitions are useful for defining a climate phenomenon that is difficult to isolate from normal climate patterns for a region.

Drought is not a rare and random climate event; rather, it is a normal, naturally recurring feature of climate. Drought may occur in virtually all climatic zones, but its characteristics vary significantly from one region to another. Drought is a temporary aberration and is different from aridity, which is restricted to low rainfall regions and is a permanent feature of climate.

There are four academic approaches to examining droughts; these are meteorological, hydrologic, agricultural, and socio-economic. Meteorological drought is based on the degree, or measure, of dryness compared to a normal, or average amount of dryness, and the duration of the dry period. Hydrological drought is associated with the effects of periods of precipitation (including snowfall) shortfalls on surface or subsurface water supply. Agricultural drought is related to agricultural impacts; focusing on precipitation shortages, differences between actual and potential evapotranspiration, soil water deficits, reduced ground water or reservoir levels, and crop yields. Socioeconomic drought relates to the supply and demand of some economic good with elements of meteorological, hydrological, and agricultural drought. This last approach relates the lack of moisture to community functions in the full range of societal function, including power generation, the local economy, and food sources.

Drought: Historic Data

There have been several statewide droughts since 1930. One of the most severe events occurred between the years of 1988 and 1989. Statewide crop yields in 1988 were 50% to 86% less than in the previous year. Additionally, the IDNR issued a 90-day water conservation decree for portion of the northwest quadrant of Indiana. State surface-water reservoirs approached, and in some cases reached, record low water levels, and around the state some power plants reduced, or shut down, operations temporarily where cooling reservoirs fell to a level that could not support the capacity to cool discharge waters from the plants. In Marion County, at the USGS gauging station on the White River near Nora, mean daily stream flows for 1988, indicated that 1988 stream flows were the 10th lowest on record and that monthly mean stream flows for May and June were the fourth and third lowest on record. However, reservoir levels in the County were not greatly impacted.

One of the most common indicators of drought is the Palmer Drought Severity Index, which is a soil moisture algorithm calibrated for relatively homogenous regions. The indicator is used by numerous federal and state agencies to trigger drought relief programs. According to the Palmer Drought Severity Index, Marion County experienced extreme drought between 5% and 9.9% of the time between 1895 and 1995. In addition, according to the Palmer Drought Severity Index, during 1988 Marion County experienced extreme drought conditions for more than 50% of the year.

Additionally, the Climate Prediction Center of the National Weather Service issues a seasonal drought outlook for the United States. According to the Climate Prediction Center, Marion County is not likely to experience drought conditions between January and April 2006. Based on historic information, the probability of a drought occurring in Marion County is possible. **Table 3-20** identifies the CPRI for a drought event for all NFIP communities in Marion County.

Table 3-20: Calculated Priority Risk Index for Drought

	Probability <ul style="list-style-type: none"> • Unlikely • Possible • Likely • Highly likely 	Magnitude/Severity <ul style="list-style-type: none"> • Negligible • Limited • Critical • Catastrophic 	Warning Time <ul style="list-style-type: none"> • > 24 hrs • 12-24 hrs • 6-12 hrs • < 6 hrs 	Duration of Event <ul style="list-style-type: none"> • < 6 hrs • < 1 day • < 1 wk • > 1 wk 	CPRI
City of Indianapolis	Possible	Limited	> 24 hours	> 1 week	2.1
City of Beech Grove	Possible	Limited	> 24 hours	> 1 week	2.1
City of Lawrence	Possible	Limited	> 24 hours	> 1 week	2.1
City of Southport	Possible	Limited	> 24 hours	> 1 week	2.1
Town of Speedway	Possible	Limited	> 24 hours	> 1 week	2.1

As the table shows, there is no significant difference in CPRI values among Marion County communities due to the wide regional impact of a drought event.

Drought: Vulnerability Assessment

Droughts can affect all sectors of society and can result in lost row crop and livestock revenue, decreased tourism revenues, increased food prices, and overall decreased tax bases for municipalities and local governments. FEMA estimates that the nation wide annual economic impact associated with droughts ranges from \$6-8 billion, and the 1988 drought was estimated to account for approximately \$40 billion in economic impacts. In addition, according to the National Drought Mitigation Center (NDMC), the drought of 2002, which did not impact Indiana or Marion County, but did impact large parts of United States including Colorado, Kansas, Missouri, and Montana resulted in \$2.5 billion in indemnities, \$9 billion in lost livestock, \$9.5 billion in net farm income reductions, and \$1.2 billion in fire suppression expenditures. The resulting fires burned 7.2 million acres and more than 4,100 homes.

Estimates of losses associated with a severe drought in Marion County are difficult to determine with readily available information. However, by utilizing the estimated crop yield decrease reported in 1988 and 1989, just after the 1988 drought period, as 50% – 86% of 1987 yields (assuming a typical year), then economic losses associated with a drought in Marion County could range between \$500,000 and \$1.8 million depending on crop types produced and market demand.

According to the NDMC, drought impacts are inherently hard to quantify, therefore there has not been a comprehensive and consistent methodology for quantifying drought impacts and economic losses in the United States. In response to this issue, the NDMC has developed the Drought Impact Reporter, which is intended to be the initial step in creating a comprehensive database of economic impacts associated with drought across the United States. The principal goal of the *Drought Impact Reporter* is to collect, quantify, and map reported drought impacts for the United States and provide access to the reports through interactive search tools.

The need for the Drought Impact Reporter and its comprehensive database becomes clear when one considers that drought is a normal part of the climate for virtually all portions of the United States. In addition, all evidence suggests that the impacts of drought are increasing in magnitude and complexity. A risk management approach to drought management, which strongly emphasizes improved monitoring and preparedness, requires more timely information

on the severity and spatial extent of drought and its associated impacts. Improved information on drought impacts will help policy and decision makers identify what types of impacts are occurring and where. More precise estimates of drought impacts will also aid the government in instituting programs before drought occurs, as opposed to incurring high expenditures on post-drought relief.

Drought: Existing Mitigation Practices

Mitigation practices are projects, policies, or programs that reduce the social, physical, and economic impact of hazards. As part of this planning process, the Planning Committee discussed the strengths and weaknesses of existing mitigation practices and made recommendations for improvements as well as suggested new practices. The following is a summary of the mitigation practices discussed. A chart detailing all of the mitigation practices, hazards address, local priority, benefit-cost ratio, location, responsible entity, and funding can be found in Section 4.0 of this Plan.

It is possible that a drought could affect Marion County. However, currently there are very few mitigation practices for reducing losses associated with drought. As noted in the Indiana Water Shortage Plan, water conservation may be necessary to ensure there is adequate water for fire fighting purposes and proper operation of critical facilities. This can be accomplished through the passing of an emergency ordinance, by incorporating emergency water conservation measures into existing ordinances, and through the promotion and implementation of day-to-day water-saving measures such as installing low-flow water saving showerheads and toilets in all critical and non-critical facilities where applicable. In addition, in 2006, the Indiana General Assembly passed Senate Bill 369, which established a Water Shortage Task Force that is responsible for implementing the Water Shortage Plan and updating, expanding, and revising the Water Shortage Plan to include a low flow and drought and priority use schedule.

Social, physical, and economic losses from drought will most likely increase as more people choose to live, work, and utilize water resources in Marion County. Ensuring that residents and visitors are well informed about the potential impacts from drought and proper methods to conserve water will help reduce future losses and damage.

3.2.9 EARTHQUAKE

An earthquake is a sudden, rapid shaking of the earth caused by the breaking and shifting of rock beneath the earth's surface. For hundreds of millions of years, the forces of plate tectonics have shaped the earth as the huge plates that form the earth's surface move slowly over, under, and past each other. Sometimes the movement is gradual. At other times, the plates are locked together, unable to release the accumulating energy. When the accumulated energy grows strong enough, the plates break free, causing the ground to shake. Most earthquakes occur at the boundaries where the plates meet; however, some earthquakes occur in the middle of plates.



Ground shaking from earthquakes can collapse buildings and bridges; disrupt gas, electric, and phone service; and sometimes trigger landslides, avalanches, flash floods, fires, and huge, destructive ocean waves (tsunamis). Buildings with foundations resting on unconsolidated landfill and other unstable soil, and trailers and homes not tied to their foundations are at risk because they can move off their mountings during an earthquake. When an earthquake occurs in a populated area, it may cause deaths, injuries, and extensive property damage.

Earthquakes strike suddenly, without warning. Earthquakes can occur at any time of the year and at any time of the day or night. On a yearly basis, 70 to 75 damaging earthquakes occur throughout the world. Estimates of losses from a future earthquake in the United States approach \$200 billion.

There are 45 states and territories in the United States at moderate to very high risk from earthquakes, and they are located in every region of the country. California experiences the most frequent damaging earthquakes; however, Alaska experiences the greatest number of large earthquakes—most located in uninhabited areas. The largest earthquakes felt in the United States were along the New Madrid Fault in Missouri, where a three-month long series of quakes from 1811 to 1812 included three quakes larger than a magnitude of 8 on the Richter Scale. These earthquakes occurred over the entire Eastern United States, with Missouri, Tennessee, Kentucky, Indiana, Illinois, Ohio, Alabama, Arkansas, and Mississippi experiencing the strongest ground shaking.

Earthquake: Historic Data

Although there are no known previous occurrences of earthquakes recorded in Marion County, it is possible considering the County's proximity to the New Madrid fault line that the County could experience an earthquake or the aftershock of an earthquake at some point in the future. The most significant earthquakes affecting the State of Indiana were from the Great New Madrid Earthquakes of 1811-1812. These were a series of large earthquakes, the three largest of which were believed to be larger than a magnitude 8.0 on the Richter Scale, with hundreds of aftershocks in various magnitude ranges. The area hit hardest by these events was the New Madrid Seismic Zone in Southern Illinois.

The most recent earthquake recorded in central Indiana occurred on September 12, 2004 in Shelbyville, IN. The earthquake recorded a magnitude 3.6 on the Richter Scale of earthquake intensity. The most recent earthquake to impact Indiana was a January 2, 2006 event that occurred about 45 miles west of Evansville, Indiana and recorded a magnitude 3.6 on the Richter Scale of Earthquake Intensity. According to the United States Geological Survey (USGS), the probability of an earthquake greater than a magnitude 5.0 occurring in Marion County in the next 100 years is between 1% and 2% percent and the probability of such an event occurring in the next 1000 years is between 10% and 20% percent.

Based on historical earthquake data, local knowledge of previous earthquake events, and the HAZUS-MH results conducted as part of this planning process, it was determined that the probability of an earthquake occurring in Marion County ranges somewhere between unlikely and possible and that the impacts of an event would be limited. If an earthquake event were to occur, the warning time would both be very short and the duration of the event would be less than 1 day. **Table 3-21** identifies the CPRI for an earthquake event for all NFIP communities in Marion County.

Table 3-21: Calculated Priority Risk Index for Earthquake

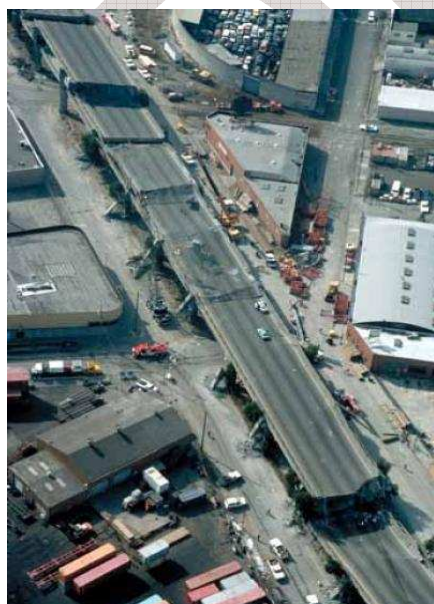
	Probability <ul style="list-style-type: none"> • Unlikely • Possible • Likely • Highly likely 	Magnitude/Severity <ul style="list-style-type: none"> • Negligible • Limited • Critical • Catastrophic 	Warning Time <ul style="list-style-type: none"> • > 24 hrs • 12-24 hrs • 6-12 hrs • < 6 hrs 	Duration of Event <ul style="list-style-type: none"> • < 6 hrs • < 1 day • < 1 wk • > 1 wk 	CPRI
City of Indianapolis	Unlikely/Possible	Limited	< 6 hours	< 1 day	2.1
City of Beech Grove	Unlikely/Possible	Limited	< 6 hours	< 1 day	2.1
City of Lawrence	Unlikely/Possible	Limited	< 6 hours	< 1 day	2.1
City of Southport	Unlikely/Possible	Limited	< 6 hours	< 1 day	2.1
Town of Speedway	Unlikely/Possible	Limited	< 6 hours	< 1 day	2.1

As shown in the CPRI table, all communities share the same value due to the large-scale regional impact of this hazard.

Earthquake: Vulnerability Assessment

Considering the large-scale regional impacts of earthquakes all 1,015 critical and 323,000 non-critical facilities identified in Marion County are considered to be at risk of being impacted by an earthquake.

The GIS-based HAZUS-MH program was used to estimate the impacts that earthquakes with magnitudes of 5.0 and 7.0 would have on Marion County communities. According to HAZUS, if a magnitude 5.0 earthquake were to occur in Marion County approximately 28,708 buildings would be damaged. Of those damaged buildings, 20,843 would receive slight damage, 6,610 would receive moderate damage, 1,100 would receive extensive damage, and 154 would be damaged beyond repair. This scenario also predicted that critical facilities such as hospitals would receive slight damage. It was predicted that within one week of the event, 80% of hospital beds would be available for use, and within a month, 97% of beds would be available for use.



However, estimated damages associated with a magnitude 7.0 earthquake are much greater. According to HAZUS, if a magnitude 7.0 earthquake were to occur in Marion County, approximately 224,193 buildings would be damaged. Of those damaged buildings, 59,156 would receive slight damage, 81,744 would receive moderate damage, 47,238 would receive extensive damage, and 36,055 would be damaged beyond repair. This scenario also predicted that critical facilities such as hospitals would be greatly impacted. On the day of the earthquake, only 2% of hospital beds would be available for use by patients already in the hospital and those impacted by the earthquake.

HAZUS-MH also estimated total economic damages associated with a magnitude 5.0 and 7.0 earthquake event. It was estimated that a magnitude 5.0 event would result in \$1,089 million in economic loss. Of this total, \$987 million are associated with building related losses including costs

associated with business interruption, \$9 million are associated with transportation related losses such as damages to roadways and railways, and \$93 million are associated with utility related losses.

As expected, the estimated economic loss associated with a magnitude 7.0 event also increased greatly. It was estimated that a magnitude 7.0 event would result in \$25,341 million in economic loss. Of this total, \$24,400 million are associated with building related losses including costs associated with business interruption, \$279 million are associated with transportation related losses such as damages to roadways and railways, and \$613 million are associated with utility related losses.

Since the HAZUS-MH Earthquake Model is still under development, the data generated should be used with some reservation. Subsequent releases may address the following limitations. Estimated losses for an individual building are actually averages for a group of similar buildings and although the buildings are similar, they may experience vastly different damage and losses during an earthquake. HAZUS-MH analyses assume general national values for the replacement costs of critical facilities and infrastructure and may not accurately represent actual local conditions.

Earthquake: Existing Mitigation Practices

Mitigation practices are projects, policies, or programs that reduce the social, physical, and economic impact of hazards. As part of this planning process, the Planning Committee discussed the strengths and weaknesses of existing mitigation practices and made recommendations for improvements as well as suggested new practices. The following is a summary of the mitigation practices discussed. A chart detailing all of the mitigation practices, hazards address, local priority, benefit-cost ratio, location, responsible entity, and funding can be found in Section 4.0 of this Plan.

There are few mitigation practices to reduce losses in the event of an earthquake. The State requires all buildings in Marion County to be constructed to meet the standards set by the International Building Code. These codes specifically address the seismic energy that each structure must be able to withstand in this region.

Due to the short warning time with earthquakes there may not be enough time to utilize safe rooms or community shelters unless to protect people from the aftershock impacts or to provide displaced residents with long-term shelter. The location of these facilities should be well advertised for both residents and visitors to Marion County. The Red Cross of Greater Indianapolis has agreements with schools and churches throughout the County for both temporary and long-term shelter.

An earthquake could affect above ground utilities such as electricity or communication lines. To prevent a disruption of service, back-up power is essential at critical facilities especially medical care, police, fire, and community shelter facilities. Backup generators would also be beneficial at all critical lift stations as well as major intersections. In addition to back-up generators, a back-up fuel reserve is needed to ensure that back-up generators at critical facilities have the ability to continue functioning in event that power outages last beyond 12-24 hours. Although it is not a County-wide requirement, the majority of new developments occurring in Marion County are burying energy and communication lines. Although access to buried utility lines may be more difficult when the ground is frozen, they are less likely to be damaged by earthquake events. The benefit associated with burying all existing above ground utility lines does not

outweigh the associated cost however; it does make sense for new development and redevelopment projects.

Social, physical, and economic losses from earthquakes will most likely increase as more people choose to live, work, and visit Marion County. Ensuring that residents and visitors are well informed about the potential impacts from earthquake and proper methods to protect themselves and their property will help reduce future losses and damage.

3.2.10 EXTREME TEMPERATURE

Extreme heat is defined as a temporary elevation of average daily temperatures that hover 10 degrees or more above the average high temperature for the region for the duration of several weeks. Humid or muggy conditions, which add to the discomfort of high temperatures, occur when a dome of high atmospheric pressure traps water-laden air near the ground. In a normal year, approximately 175 Americans die from extreme heat.

Extreme cold is defined as a temporary, yet sustained, period of extremely low temperatures. Extremely low temperatures can occur in winter months when continental surface temperatures are at their lowest point and the North American Jet Stream pulls arctic air down into the continental United States. The jet stream is a current of fast moving air found in the upper levels of the atmosphere. This rapid current is typically thousands of kilometers long, a few hundred kilometers wide, and only a few kilometers thick. Jet Streams are usually found somewhere between 10-15 km (6-9 miles) above the earth's surface. The position of this upper-level Jet Stream denotes the location of the strongest surface temperature contrast over the continent. The Jet Stream winds are strongest during the winter months when continental temperature extremes are greatest. When the Jet Stream pulls arctic cold air masses over portions of the United States, temperatures can drop below 0 °F for a week or more. Sustained extreme cold poses a physical danger to all individuals in a community and can affect infrastructure function as well.

Extreme Temperature: Historic Data

The effects of extreme temperatures extend across large regions, typically affecting several counties, or states, during a single event. Ten recorded cases of extreme temperature affected Marion County between 1994 and 2000. These events include 4 extreme heat events and 6 extreme cold events. **Table 3-21**, identifies the extreme temperature events, which have resulted in deaths, injuries, or property damage. The 4 extreme heat events have resulted in 16 deaths and more than \$1 Million dollars in economic damages. The 6 extreme cold events have resulted in 3 deaths and \$6 Million in economic losses. The deaths associated with these events did not occur in Marion County, and it is unclear to what extent the reported property damages occurred in Marion County.

The January 1994 extreme cold event set numerous new low temperature records for both Indiana and Marion County. On the morning of January 19th, the City of Indianapolis hit a new record low of 27 degrees below zero. The August 1995 heat wave resulted in temperatures exceeding 95 degrees for several days across the most of the state, and greatly reduced turnout to the annual Indiana State Fair. Some estimates have indicated that the low turnout resulted in approximately \$400,000 dollar in lost revenues.

Table 3-21: Historic Extreme Temperatures

Location	Date	Type	Death/ Injury	Property/ Crop Damage
Entire State	1/14/1994	Extreme Cold	3/0	\$5 M/0
Multiple Counties	7/13/1995	Heat Wave	14/0	\$1 M/0
Multiple Counties	8/21/1995	Heat Wave	1/0	0/0
Marion County	6/14/2000	Excessive Heat	1/0	0/0
TOTAL			19/0	\$6 M/0

(Marion County Hazard Analysis, 2004 & NCDC, 2005)

It is difficult to predict the probability that an extreme temperature event will impact Marion County residents in any given year. However, based on historic information an extreme temperature event is certainly possible in any given year. Although the warning time associated with extreme temperatures is typically greater than 24 hours, the duration of the event could last for more than a week. **Table 3-22** identifies the CPRI for extreme temperature events for all NFIP communities in Marion County.

Table 3-22: Calculated Priority Risk Index for Extreme Temperature

	Probability <ul style="list-style-type: none"> • Unlikely • Possible • Likely • Highly likely 	Magnitude/ Severity <ul style="list-style-type: none"> • Negligible • Limited • Critical • Catastrophic 	Warning Time <ul style="list-style-type: none"> • > 24 hrs • 12-24 hrs • 6-12 hrs • < 6 hrs 	Duration of Event <ul style="list-style-type: none"> • < 6 hrs • < 1 day • < 1 wk • > 1 wk 	CPRI
City of Indianapolis	Possible	Limited	> 24 hours	< 1 week	2.0
City of Beech Grove	Possible	Limited	> 24 hours	< 1 week	2.0
City of Lawrence	Possible	Limited	> 24 hours	< 1 week	2.0
City of Southport	Possible	Limited	> 24 hours	< 1 week	2.0
Town of Speedway	Possible	Limited	> 24 hours	< 1 week	2.0

Extreme Temperature: Vulnerability Assessment

Certain portions of the population may be more vulnerable to extreme temperatures. For example, outdoor laborers, very young and very old populations, low income populations, populations in poor physical condition, and people without heat and air conditioning are at an increased risk to be impacted by extreme temperatures.

Extreme heat can affect the proper function of organ and brain systems by elevating core body temperatures above normal levels. Elevated core body temperatures are often exhibited as heat stroke. For weaker individuals, an overheated core body temperature places additional stress on the body, and the body must remain hydrated in order to cool down. Elderly people and infants are most susceptible to suffering from extreme heat events and it is important that these populations keep well hydrated and cool during these events.

At the other extreme, very cold temperatures also pose a threat to human health if they cause core body temperature to fall much below normal levels for an extended period. Lowered core body temperatures in individuals can lead to hypothermia. Keeping the core body temperature in the normal range of function typically requires an operational and reliable heat source other than the body. Those who are not able to access a proper heat source could be in danger.

Due to the nature of extreme temperature events, it is difficult to assess to the economic losses that might result from an extreme temperature event in Marion County. However, by assessing the demographics of Marion County we can gain an understanding of the relative risk that extreme temperatures may pose to certain populations within Marion County. In total, more than 11% of the County's population is over 65 years of age, more than 7% of the population is below the age of 5, and approximately 12% are considered to be living below the poverty line. People in these demographic groups are more susceptible to the health or social impacts associated with extreme temperatures.

Extreme Temperature: Existing Mitigation Practices

Mitigation practices are projects, policies, or programs that reduce the social, physical, and economic impact of hazards. As part of this planning process, the Planning Committee discussed the strengths and weaknesses of existing mitigation practices and made recommendations for improvements as well as suggested new practices. The following is a summary of the mitigation practices discussed. A chart detailing all of the mitigation practices, hazards address, local priority, benefit-cost ratio, location, responsible entity, and funding can be found in Section 4.0 of this Plan.

In the event of a prolonged extreme temperature event, community shelters may be needed as cooling or heating centers for those with inadequate climate control units. The location of designated cooling and heating centers should be well advertised for both residents and visitors to Marion County. The Red Cross of Greater Indianapolis has agreements with schools and churches throughout the County for both temporary and long-term shelter.

An extreme temperature event could result in power outages. To prevent a disruption of service, back-up power is essential at critical facilities especially medical care, police, fires, and community shelter facilities. Backup generators would also be beneficial at all critical lift stations as well as major intersections.

Social, physical, and economic losses from extreme temperatures will most likely increase as more people choose to live, work, and visit Marion County. Ensuring that residents and visitors are well informed about the potential impacts from extreme temperatures and proper methods to protect themselves and their property will help reduce future losses and damage.

3.2.11 FIRE

A structural fire is an event where a fire starts within a structure, and is largely contained to that structure. Causes of structural fires can be related to electrical shorts, carelessness with ignition sources, poor storage of flammable materials, as well as arson. These types of fires can be deadly if no warning or prevention measures are present. The most dangerous aspect of structural fires is the production of toxic gases and fumes that can quickly accumulate in enclosed areas of structures and asphyxiate those who might be in the structure. Thus, early warning of a structural fire is critical for survival of any person inside the structure.

Problems associated with structural fires are compounded when high-rise buildings catch fire. High-rise fires hinder the ability of rescue workers to fight the fire, reach impacted building occupants, and to evacuate impacted occupants. Rescue efforts also become more complicated when handicapped or disabled persons are involved. Complications associated with high-rise fires typically increase as the height and occupancy levels of the buildings increase. Structural collapse is another concern associated with high-rise fires. Structural collapse often results in persons becoming trapped and severely injured. However, it is important to note that the concern associated with structural collapse, is not limited to high-rise buildings. The collapse of smaller residential buildings can also lead to severe injury and death.



Marion County residents are served by:

- Beech Grove Fire Department
- Decatur Township Fire Department
- Franklin Township Fire Department
- Indianapolis International Airport Fire Department
- Indianapolis Fire Department
- City of Lawrence Fire Department
- Lawrence Township Fire Department
- Perry Township Fire Department
- Pike Township Fire Department
- Speedway Fire Department
- Warren Township Fire Department
- Washington Township Fire Department
- Wayne Township Fire Department

Fire: Historic Data

According to the Marion County Comprehensive Hazard Analysis, there have been seven significant fire events since 1890. These significant events are shown in **Table 3-23**.

Table 3-23: Significant Fire Events in Marion County

Location	Date	Type	Death/ Injuries	Damage
Bowen-Merrill Book	3/17/1890	Structural Fire	13/15	\$200 K
Indiana State Fair	10/31/1963	Explosion	74/400	\$4 M
Fall Creek/Fairground	8/14/1969	Explosion	1/16	\$250 K
37 E. Washington St.	11/5/1973	Structural Fire	NA	\$16 M
Indianapolis Athletic Club	2/5/1992	High-Rise Fire	3/NA	\$250 K
1500 W. Washington St.	12/16/2003	Structural Collapse	NA	NA
373 S. Ritter Ave.	2/4/2004	Explosion	0/2	\$900 K
County-wide	ongoing	Arson	NA	NA
TOTAL			91/423	\$21.6 M

The 1890 Bowen-Merill Book House fire resulted in the tragic death of one-third of the Indianapolis Fire Department. The 1963 explosion at the State Fair Grounds resulted when a

propane gas leak sparked an explosion, which killed 74 and injured 400 spectators at the Holiday on Ice Show.

The 1992 fire at the Indianapolis Athletic Club in downtown Indianapolis is the only significant high-rise fire known to have occurred in Marion County. Electrical problems on the third floor of the Athletic Club sparked a fire that resulted in the death of three local citizens and a quarter of a million dollars in damages. In February 2004, a gas leak led to an explosion on S. Ritter Street. The explosion resulted in 2 deaths, damage to more than 60 buildings, and the evacuation of a nursing home. Finally, arson is a countywide problem with 300 suspected arsons occurring each year. One of the most significant arson related fires occurred between 10th and 11th Streets in Indianapolis in 1918. The fire was believed to be set by German saboteurs.

In terms of annual loss of life and property, fires are potentially one of the most devastating hazards facing Marion County every year. An estimated 23 fire related deaths occur in Marion County each year, and direct property losses associated with these events can be in the millions of dollars on an annual basis. Between 1999 and 2003, the Indianapolis Fire Department averaged approximately 12,900 fire suppression runs per year. Comparatively, the City of Beech Grove averaged only 1,200 fire runs per year over the same period. The estimated average annual losses associated with Beech Grove fires over this time period was approximately \$570,000. In 2004, the Town of Speedway made 220 fire suppression runs, which resulted in approximately 3 civilian injuries. Historically, however, the vast majority of fire hazard incidents in the County have been relatively isolated and the impact of these events have not been of a regional nature, and while these events often have a tremendous impact on the residents or businesses directly involved, they have not typically impacted a large portion of the Marion County's population. **Table 3-24** identifies the CPRI for a structural fire event for all NFIP communities in Marion County.

Table 3-24: Calculated Priority Risk Index for Fire

	Probability <ul style="list-style-type: none"> • Unlikely • Possible • Likely • Highly likely 	Magnitude/Severity <ul style="list-style-type: none"> • Negligible • Limited • Critical • Catastrophic 	Warning Time <ul style="list-style-type: none"> • > 24 hrs • 12-24 hrs • 6-12 hrs • < 6 hrs 	Duration of Event <ul style="list-style-type: none"> • < 6 hrs • < 1 day • < 1 wk • > 1 wk 	CPRI
City of Indianapolis	Unlikely	Limited	< 6 hours	< 1 day	1.9
City of Beech Grove	Unlikely	Limited	< 6 hours	< 1 day	1.9
City of Lawrence	Unlikely	Limited	< 6 hours	< 1 day	1.9
City of Southport	Unlikely	Limited	< 6 hours	< 1 day	1.9
Town of Speedway	Unlikely	Limited	< 6 hours	< 1 day	1.9

Fire: Vulnerability Assessment

Given the unpredictable nature of fire hazards, an estimate of potential losses associated with this hazard is hard to predict. Vulnerable structures may be found in all land use classes throughout Marion County and include all 1,015 critical and 323,711 non-critical facilities.

Relatively speaking, high-rise fires are likely to have the greatest social and economic losses of all fire hazards. As mentioned in the Marion County Comprehensive Hazard Analysis, the

Indianapolis Fire Department could handle the occurrence of a high-rise fire without over depleting their resources; however, the surrounding Township Departments do not have the resources to handle a significant high-rise fire in their communities without calling on the services of Mutual Aide responders. A significant high-rise fire involving a commercial structure would be likely to displace several business and their employees, and losses would include both structural damages and business interruptions. In the event of a significant high-rise fire involving a residential complex, shelters and safe havens would be needed for resident displacement, and in the long-run housing replacements would be needed.

According to report by the National Fire Prevention Association, in the year 2004 there were approximately 1.5 million fires, 3,900 fire fatalities, 17,000 fire related injuries, and more than \$9.7 million in fire related property losses in the United States. Utilizing 2004 data, the report estimated that communities the size of Marion County would have experienced approximately 8 fire related deaths, 47 fire related injuries, and more than \$23 million in fire related damages in 2004. It is important to note that these estimates utilize national data collected in 2004 and are not necessarily specific to Marion County NFIP communities.

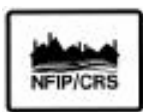
Fire: Existing Mitigation Practices

Mitigation practices are projects, policies, or programs that reduce the social, physical, and economic impact of hazards. As part of this planning process, the Planning Committee discussed the strengths and weaknesses of existing mitigation practices and made recommendations for improvements as well as suggested new practices. The following is a summary of the mitigation practices discussed. A chart detailing all of the mitigation practices, hazards address, local priority, benefit-cost ratio, location, responsible entity, and funding can be found in Section 4.0 of this Plan.

Fire Departments located within Marion County currently have mitigation measures in place designed to minimize future impacts associated with fire hazards. The Marion County Fire Chief's Association is a collective body of jurisdictional Fire Chiefs, whose main mission is to provide a positive and constructive means of preventing fires and fire-related incidents within the County and coordinating Standard Operating Procedures and Guidelines and trainings within the Marion County fire services. Their main method of accomplishing this mission is to provide training for all fire service personnel and to establish community outreach programs focused on fire safety for children, homes, and businesses.

In the event that a significant fire results in citizen displacement, community shelters and safe havens may be needed. The location of designated shelters and safe havens should be well advertised for both residents and visitors to Marion County. The Red Cross of Greater Indianapolis has agreements with schools and churches throughout the County for both temporary and long-term shelter.

Social, physical, and economic losses associated with fire hazards will most likely increase as more people choose to live, work, and visit Marion County. Ensuring that residents and visitors are well informed about the potential impacts from fire hazards and proper methods to protect themselves and their property will help reduce future losses and damage.



The CRS program credits NFIP communities a maximum of 55 points for mapping flooding as well as other known natural hazards; summarizing the impact of natural hazards; identifying the number, type, and estimated value of buildings subject to natural hazards; and development, the community.

4.0 COMMUNITY CAPABILITY ASSESSMENT

This Section identifies the mitigation goals and a summary of the mitigation practices discussed in the Risk Assessment section of this MHMP.

4.1 MITIGATION GOALS

To facilitate the discussion, the Planning Committee prepared multi-hazard mitigation goals in terms of the six mitigation measures used by FEMA – prevention, property protection, natural resource protection, emergency services, structural control, and public information.

Prevention

FEMA defines prevention as measures that are designed to keep the problem from occurring or getting worse. The multi-hazard goal for prevention for the Marion County NFIP communities is to continue to manage the development of land and buildings to reduce the impact of hazards on people and property. Prevention measures will be implemented through improvements in land use planning and zoning, better floodplain management, additional safe rooms and community shelters, continued tree maintenance program, participation in the CRS program, and the use and location of utility lines.

Property Protection

FEMA defines property protection as measures that are used to modify buildings subject to hazard damage rather than to keep the hazard away. The multi-hazard goal for property protection for the Marion County NFIP communities is to modify the buildings subject to hazard damage to protect people and property from the impacts of hazards. Property protection measures will be implemented by ensuring buildings are protected and insured.

Natural Resource Protection

FEMA defines natural resource protection as opportunities to preserve and restore natural areas and their function to reduce the impact of hazards. The multi-hazard goal for natural resource protection for the Marion County NFIP communities is to preserve and maintain the function of existing natural resources to reduce the impact of hazards to people and property. Natural resource protection measures will be implemented through improved stormwater management and better floodplain management.

Emergency Services

FEMA defines emergency services as measures that protect people during and after a hazard. The multi-hazard goal for emergency services for the Marion County NFIP communities is to improve the efficiency, timing and effectiveness of warning, as well as response and recovery efforts before, during, and after a hazard. Emergency services will be implemented through improvements to emergency warning systems, through the development of a Marion county CERT, and by developing a voluntary immunization program for emergency responders.

Structural Control

FEMA defines structural control as physical measures used to prevent hazards from reaching a property. The multi-hazard goal for structural control projects for the Marion County NFIP communities is to continue to use structural control projects, where feasible, to minimize the potentially damaging effects of hazards on people and property. Structural control measures will be implemented through the maintenance and management of high hazard dams.

Public Information

FEMA defines public information activities as those that advise property owners, potential property owners, and visitors about the hazards, ways to protect themselves and their property from the hazards. The multi-hazard goal for public information for the Marion County NFIP communities is to continue to educate and inform the public about the risks of hazards and ways to protect themselves and their property. Public information measures will be implemented through increased participation at community events, availability, and distribution of hazard preparedness literature.

4.2 MITIGATION PRACTICES

In 2005, the Multi-Hazard Mitigation Council conducted a study about the benefits of hazard mitigation. This study examined grants over a 10-year period (1993-2003) aimed at reducing future damaged from earthquake, wind, and flood. It found that mitigation efforts were cost-effective at reducing future losses; resulted in significant benefits to society; and represented significant potential savings to the federal treasury in terms of reduced hazard-related expenditures. This study found that every \$1 spent on mitigation efforts resulted in an average of \$4 savings for the community. The study also found that FEMA mitigation grants are cost-effective since they often lead to additional non-federally funded mitigation activities, and have the greatest benefits in communities that have institutionalized hazard mitigation programs.

The Planning Committee reviewed the list of mitigation ideas from FEMA for each of the hazards studied as part of this planning effort and identified which of these best met their needs as a community according to selected social, technical, administrative, political, and legal criteria. The following identifies the key considerations for each evaluation criteria:

- **Social** – the proposed mitigation projects will have community acceptance, they are compatible with present and future community values, and do not adversely affect one segment of the population.
- **Technical** – the proposed mitigation project will be technically feasible, reduce losses in the long-term, and will not create more problems than they solve.
- **Administrative** – the proposed mitigation projects may require additional staff time, alternative sources of funding, and have some maintenance requirements.
- **Political** – the proposed mitigation projects will have political and public support.
- **Legal** – the proposed mitigation projects will be implemented through the laws, ordinances, and resolutions that are in place.

Table 4-1 includes a summary of all existing and proposed mitigation practices identified for all hazards, as well as information on the local status, local priority, benefit-cost ratio, project location, responsible entity, and potential funding source, associated with each proposed practice. The proposed mitigation practices are listed in order of importance to the Marion County NFIP communities for implementation. Projects identified by the Planning Committee to be of “high” local priority may be implemented within 2-3 years from final Plan adoption. Projects identified to be of “medium” local priority may be implemented within 4-5 years from final Plan adoption, and projects identified by the Planning Committee to be of “low” local priority may be implemented within 5+ years from final Plan adoption. However, depending on the availability of funding some proposed mitigation projects may take longer to implement.

As part of the process to identify mitigation practices, the Planning Committee weighed the benefit derived from each mitigation practice with the estimated cost of that practice. The Planning Committee identified the mitigation practices as having a high, medium, or low benefit cost ratio based on their experience and professional judgment. Preparing detailed benefit cost

ratios was beyond the scope of this planning effort and the intent of the MHMP. The development of this MHMP is the necessary first step of a multi-step process to implement programs, policies, and projects to mitigate the effect of hazards in Marion County communities. The intent of this planning effort was to identify the hazards and the extent to which they affect Marion County communities and to determine what type of mitigation strategies or practices may be undertaken to mitigate for these hazards. Although this MHMP meets the requirements of DMA 2000 and eligibility requirements of the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Act (FMA), Pre-Disaster Mitigation (PDM) Grant, as well as other FEMA programs including the NFIP's Community Ratings System (CRS), additional detailed studies may need to be completed prior to applying for these grants or programs. **Section 5** of this plan includes an implementation plan for all high priority mitigation practices identified by the Planning Committee.



The CRS program credits NFIP communities a maximum of 72 points for setting goals to reduce the impact of flooding and other known natural hazards; identifying mitigation projects that include activities for prevention, property protection, natural resource protection, emergency services, structural control projects, and public information.

Table 4-1: Summary of Mitigation Practices

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT -COST RATIO	PROJECT LOCATION	RESPONSIBLE ENTITY	FUNDING SOURCE
Floodplain Mapping Studies <ul style="list-style-type: none">Continue to complete detailed hydraulic analyses of unstudied and Approximate Zone A streams to determine exact floodplain boundaries.Update 1999 Floodplain Prioritization Study to reflect recent studies, economic loss, and any changes to prioritization.	<input checked="" type="checkbox"/> Prevention <input type="checkbox"/> Property Protection <input checked="" type="checkbox"/> Nat. Res. Protection <input type="checkbox"/> Emergency Services <input type="checkbox"/> Structural Control <input checked="" type="checkbox"/> Public Information	<input checked="" type="checkbox"/> Flooding <input type="checkbox"/> Dam/Levee Failure <input type="checkbox"/> Tornado/Windstorm <input type="checkbox"/> Severe Winter Storm <input type="checkbox"/> Civil Disturbance <input type="checkbox"/> Hailstorm <input type="checkbox"/> Hazardous Material <input type="checkbox"/> Drought <input type="checkbox"/> Earthquake <input type="checkbox"/> Extreme Temperature <input type="checkbox"/> Fire	Ongoing – About 129 miles of Approximate Zone A or unstudied streams were identified in the 2002. Detailed studies on several streams have been completed or are in process. Proposed Enhancement – Continue to conduct detailed hydraulic analyses of unstudied or Approximate Zone A streams.	High	High	Continue to focus on Approximate Zone A streams with flooding problems and/or where there is development pressure.	Indianapolis (DMD) IDNR FEMA	Existing budget FEMA
Management of Dams <ul style="list-style-type: none">Complete Emergency Action Plans (EAP) for existing high hazard and significant hazard damsRequire EAPs for all new high hazard and significant hazard damsRestrict access to authorized personnel onlyAlert property owners in dam inundation areas about the potential hazard	<input checked="" type="checkbox"/> Prevention <input checked="" type="checkbox"/> Property Protection <input checked="" type="checkbox"/> Nat. Res. Protection <input checked="" type="checkbox"/> Emergency Services <input checked="" type="checkbox"/> Structural Control <input checked="" type="checkbox"/> Public Information	<input checked="" type="checkbox"/> Flooding <input checked="" type="checkbox"/> Dam/Levee Failure <input type="checkbox"/> Tornado/Windstorm <input type="checkbox"/> Severe Winter Storm <input type="checkbox"/> Civil Disturbance <input type="checkbox"/> Hailstorm <input type="checkbox"/> Hazardous Material <input type="checkbox"/> Drought <input type="checkbox"/> Earthquake <input type="checkbox"/> Extreme Temperature <input type="checkbox"/> Fire	Ongoing – Proposed Enhancement – Complete EAPs, restrict access, and alert downstream property owners	High (EAP) Low (restrict access and alert property owners)	High	High Hazard Dams: Geist Reservoir Dam, Eagle Creek Reservoir Dam, Castlebrook Dam, and College Park Dam Significant Hazard Dams: Warren Lake Dam, Pogues Run Dam, Indian Lake Dam	Dam Owner IDNR <i>Police for:</i> Indianapolis Lawrence	Existing budget FEMA
Community Ratings System <ul style="list-style-type: none">Reduce flood insurance premiums through participation in the Community Ratings System (CRS) program	<input checked="" type="checkbox"/> Prevention <input type="checkbox"/> Property Protection <input type="checkbox"/> Nat. Res. Protection <input type="checkbox"/> Emergency Services <input type="checkbox"/> Structural Control <input checked="" type="checkbox"/> Public Information	<input checked="" type="checkbox"/> Flooding <input checked="" type="checkbox"/> Dam/Levee Failure <input type="checkbox"/> Tornado/Windstorm <input type="checkbox"/> Severe Winter Storm <input type="checkbox"/> Civil Disturbance <input type="checkbox"/> Hailstorm <input type="checkbox"/> Hazardous Material <input type="checkbox"/> Drought <input type="checkbox"/> Earthquake <input type="checkbox"/> Extreme Temperature <input type="checkbox"/> Fire	Ongoing – Proposed Enhancement – All NFIP communities should participate in the CRS program.	High	High	All NFIP communities in Marion County.	<i>NFIP Coordinator for:</i> Indianapolis Beech Grove Lawrence Southport Speedway	Existing budget FEMA

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT -COST RATIO	PROJECT LOCATION	RESPONSIBLE ENTITY	FUNDING SOURCE
Emergency Warning Systems <ul style="list-style-type: none">Improve outdoor warning siren coverage to alert the local population of severe weather events.Require NOAA Weather Radios in all critical facilities and encourage use by residents and businesses.Evaluate coverage from existing stream gages to determine if there is adequate warning time.	<input type="checkbox"/> Prevention <input type="checkbox"/> Property Protection <input type="checkbox"/> Nat. Res. Protection <input checked="" type="checkbox"/> Emergency Services <input type="checkbox"/> Structural Control <input checked="" type="checkbox"/> Public Information	<input checked="" type="checkbox"/> Flooding <input checked="" type="checkbox"/> Dam/Levee Failure <input checked="" type="checkbox"/> Tornado/Windstorm <input checked="" type="checkbox"/> Severe Winter Storm <input type="checkbox"/> Civil Disturbance <input checked="" type="checkbox"/> Hailstorm <input type="checkbox"/> Hazardous Material <input type="checkbox"/> Drought <input type="checkbox"/> Earthquake <input type="checkbox"/> Extreme Temperature <input type="checkbox"/> Fire	Ongoing – Good coverage by outdoor warning systems and NWS storm warnings; NOAA weather radios installed in some critical facilities; redundancy of communication system; mobile EOC; monitor water levels with existing gages Proposed Enhancement – Install additional outdoor warning sirens and NOAA weather radios. Add stream gages upstream of urbanizing areas, in conjunction with major public works projects and advocate the same for upstream communities.	High (sirens & radios) Low (stream gages)	High	Install additional outdoor warning systems throughout the County. Require NOAA weather radios in all critical facilities. Weather radios are a secondary priority behind outdoor warning systems.	EMD Building owner (private & public)	Existing budget FEMA USGS IDNR
Community Emergency Response Teams <ul style="list-style-type: none">Establish a Marion County Community Emergency Response Team (CERT) in order to educate people about disaster preparedness and improve emergency response at the local level.	<input type="checkbox"/> Prevention <input type="checkbox"/> Property Protection <input type="checkbox"/> Nat. Res. Protection <input checked="" type="checkbox"/> Emergency Services <input type="checkbox"/> Structural Control <input checked="" type="checkbox"/> Public Information	<input checked="" type="checkbox"/> Flooding <input checked="" type="checkbox"/> Dam/Levee Failure <input checked="" type="checkbox"/> Tornado/Windstorm <input checked="" type="checkbox"/> Severe Winter Storm <input type="checkbox"/> Civil Disturbance <input checked="" type="checkbox"/> Hailstorm <input checked="" type="checkbox"/> Hazardous Material <input checked="" type="checkbox"/> Drought <input checked="" type="checkbox"/> Earthquake <input type="checkbox"/> Extreme Temperature <input type="checkbox"/> Fire	Ongoing – Proposed Enhancement – Establish a Marion County CERT.	High	High	Countywide	EMD Police and Fire Departments for: Indianapolis Beech Grove Lawrence Southport Speedway	Citizen Corps
Management of Levees <ul style="list-style-type: none">Conduct regular inspections of leveesRestrict access and prohibit encroachment on public leveesImprove condition of those levees in poor and fair conditionMaintain records of private levees	<input checked="" type="checkbox"/> Prevention <input checked="" type="checkbox"/> Property Protection <input checked="" type="checkbox"/> Nat. Res. Protection <input type="checkbox"/> Emergency Services <input checked="" type="checkbox"/> Structural Control <input checked="" type="checkbox"/> Public Information	<input checked="" type="checkbox"/> Flooding <input checked="" type="checkbox"/> Dam/Levee Failure <input type="checkbox"/> Tornado/Windstorm <input type="checkbox"/> Severe Winter Storm <input type="checkbox"/> Civil Disturbance <input type="checkbox"/> Hailstorm <input type="checkbox"/> Hazardous Material <input type="checkbox"/> Drought <input type="checkbox"/> Earthquake <input type="checkbox"/> Extreme Temperature <input type="checkbox"/> Fire	Ongoing – Inspections conducted following major storm. Public and known private levees documented and maintained. Proposed Enhancement – Conduct regular inspections, restrict access, improve condition, document private levees	High (inspection improve condition) Low (restrict access and document private levees)	Medium	Levees along Eagle Creek, Little Eagle Creek, White River, Pogues Run, and Fall Creek protect critical and non-critical facilities in Speedway and Indianapolis. Levees along Eagle Creek and White River are in poor condition. Other than Fall Creek, at least one levee on each waterway does not protect against the 100-yr flood	Levee Owner Indianapolis (DPW) Speedway	Existing budget FEMA

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT -COST RATIO	PROJECT LOCATION	RESPONSIBLE ENTITY	FUNDING SOURCE
Building Protection <ul style="list-style-type: none">Prohibit construction of critical facilities in known hazard areasProtect existing structures from known hazard areas through acquisition, relocation, elevation, and floodproofing (non-residential).	<input type="checkbox"/> Prevention <input checked="" type="checkbox"/> Property Protection <input type="checkbox"/> Nat. Res. Protection <input type="checkbox"/> Emergency Services <input checked="" type="checkbox"/> Structural Control <input checked="" type="checkbox"/> Public Information	<input checked="" type="checkbox"/> Flooding <input checked="" type="checkbox"/> Dam/Levee Failure <input type="checkbox"/> Tornado/Windstorm <input type="checkbox"/> Severe Winter Storm <input type="checkbox"/> Civil Disturbance <input type="checkbox"/> Hailstorm <input type="checkbox"/> Hazardous Material <input type="checkbox"/> Drought <input type="checkbox"/> Earthquake <input type="checkbox"/> Extreme Temperature <input type="checkbox"/> Fire	Ongoing – Flood Control District Zoning Ordinance allows new development and improvements to structures in the floodplain however it must be protected 2’ above the BFE Proposed Enhancement – Prohibit construction of future critical facilities and protect existing structures in known hazard areas.	High <i>(critical facilities)</i> Medium <i>(non-critical facilities)</i>	Medium	All critical facilities located in known flood hazard and dam/levee inundation areas followed by the non-critical repetitive loss structures and finally the other non-critical facilities. The majority of critical facilities in known flood hazard and dam/levee inundation areas are along the White River.	<i>Planning & NFIP Coordinator for:</i> Indianapolis Beech Grove Lawrence Southport Speedway	Existing budget FEMA
Flood Protection Studies <ul style="list-style-type: none">Continue to prepare detailed flood protection studies for areas with repetitive flooding problems.Evaluate and implement recommendations of prepared studies.	<input checked="" type="checkbox"/> Prevention <input type="checkbox"/> Property Protection <input type="checkbox"/> Nat. Res. Protection <input type="checkbox"/> Emergency Services <input type="checkbox"/> Structural Control <input checked="" type="checkbox"/> Public Information	<input checked="" type="checkbox"/> Flooding <input checked="" type="checkbox"/> Dam/Levee Failure <input type="checkbox"/> Tornado/Windstorm <input type="checkbox"/> Severe Winter Storm <input type="checkbox"/> Civil Disturbance <input type="checkbox"/> Hailstorm <input type="checkbox"/> Hazardous Material <input type="checkbox"/> Drought <input type="checkbox"/> Earthquake <input type="checkbox"/> Extreme Temperature <input type="checkbox"/> Fire	Ongoing – Detailed flood studies have been prepared for most of the flooding areas along the White River. Proposed Enhancement – Evaluate and implement recommendations from existing studies. Prepare additional studies as needed and resource allow.	High <i>(implement existing studies)</i> Low <i>(additional studies)</i>	Medium	Detailed flood protection studies have been prepared but need to be implemented for Union Chapel, Beach Avenue, 77 th Street, Ravenswood, Frog Hollow, and High Acre Manor neighborhoods.	Indianapolis (DMD)	Existing budget FEMA
Safe Havens & Community Shelters <ul style="list-style-type: none">Require tornado shelters in new and existing mobile home parks.Establish safe havens and community shelters in vulnerable locations.Require safe rooms in all new public facilities.Clearly advertise location of safe havens and community shelters.	<input checked="" type="checkbox"/> Prevention <input type="checkbox"/> Property Protection <input type="checkbox"/> Nat. Res. Protection <input type="checkbox"/> Emergency Services <input checked="" type="checkbox"/> Structural Control <input checked="" type="checkbox"/> Public Information	<input checked="" type="checkbox"/> Flooding <input checked="" type="checkbox"/> Dam/Levee Failure <input checked="" type="checkbox"/> Tornado/Windstorm <input checked="" type="checkbox"/> Severe Winter Storm <input checked="" type="checkbox"/> Civil Disturbance <input checked="" type="checkbox"/> Hailstorm <input checked="" type="checkbox"/> Hazardous Material <input checked="" type="checkbox"/> Drought <input checked="" type="checkbox"/> Earthquake <input checked="" type="checkbox"/> Extreme Temperature <input checked="" type="checkbox"/> Fire	Ongoing – Red Cross has agreement with local schools and churches for shelters. Proposed Enhancement – Require tornado shelters at mobile home parks; require safe rooms in all new public facilities; work with neighborhood liaisons to establish additional local safe havens and community shelters.	High	Medium	Install tornado shelters at all new and existing mobile home parks. Establish safe havens and community shelters County-wide, especially populated areas for work and living. Public parks and gathering areas should be targeted once safe havens and community shelters are installed in populated working and living areas.	EMD Red Cross <i>School Superintendents, Churches and Neighborhood Liaisons for:</i> Indianapolis Beech Grove Lawrence Southport Speedway	Operational cost Existing budget FEMA

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT -COST RATIO	PROJECT LOCATION	RESPONSIBLE ENTITY	FUNDING SOURCE
Power Back-up Generators <ul style="list-style-type: none"> Require power back-up generators in all critical facilities. Secure a fuel reserve to ensure that critical facilities can run on power back-up generators for extended periods. Designate I-70 as a fuel reserve transportation route. 	<input type="checkbox"/> Prevention <input type="checkbox"/> Property Protection <input type="checkbox"/> Nat. Res. Protection <input checked="" type="checkbox"/> Emergency Services <input type="checkbox"/> Structural Control <input type="checkbox"/> Public Information	<input checked="" type="checkbox"/> Flooding <input checked="" type="checkbox"/> Dam/Levee Failure <input checked="" type="checkbox"/> Tornado/Windstorm <input checked="" type="checkbox"/> Severe Winter Storm <input checked="" type="checkbox"/> Civil Disturbance <input checked="" type="checkbox"/> Hailstorm <input checked="" type="checkbox"/> Hazardous Material <input checked="" type="checkbox"/> Drought <input checked="" type="checkbox"/> Earthquake <input checked="" type="checkbox"/> Extreme Temperature <input checked="" type="checkbox"/> Fire	Ongoing – Many critical facilities have power back-up generators in place. Proposed Enhancement – Ensure all critical facilities have power back-up generators.	High	Medium	Critical facilities especially medical care, police, fire, DPW, and community shelter facilities. Critical facilities in floodplains should require generators to be elevated. Once critical facilities have power back-up generators installed, NFIP communities will work to install back-up generators at major traffic signals.	Building owner (<i>private & public</i>) EMD INDOT	Operational cost Existing budget FEMA
Municipal Snowplows GPS <ul style="list-style-type: none"> Add GPS Units to all municipally owned snow plows. 	<input type="checkbox"/> Prevention <input type="checkbox"/> Property Protection <input type="checkbox"/> Nat. Res. Protection <input checked="" type="checkbox"/> Emergency Services <input type="checkbox"/> Structural Control <input type="checkbox"/> Public Information	<input type="checkbox"/> Flooding <input type="checkbox"/> Dam/Levee Failure <input type="checkbox"/> Tornado/Windstorm <input checked="" type="checkbox"/> Severe Winter Storm <input type="checkbox"/> Civil Disturbance <input type="checkbox"/> Hailstorm <input type="checkbox"/> Hazardous Material <input type="checkbox"/> Drought <input type="checkbox"/> Earthquake <input type="checkbox"/> Extreme Temperature <input type="checkbox"/> Fire	Proposed Enhancement – Add GPS Units to all municipally owned snow plows.	High	Medium	All municipally operated snowplows in the County	<i>DPW and Street Departments for:</i> Indianapolis Beech Grove Lawrence Southport Speedway	Existing budget
Building Inspectors <ul style="list-style-type: none"> Coordinate building inspection staff from all NFIP communities to promote consistent documentation and record keeping. 	<input type="checkbox"/> Prevention <input checked="" type="checkbox"/> Property Protection <input type="checkbox"/> Nat. Res. Protection <input type="checkbox"/> Emergency Services <input type="checkbox"/> Structural Control <input type="checkbox"/> Public Information	<input checked="" type="checkbox"/> Flooding <input type="checkbox"/> Dam/Levee Failure <input type="checkbox"/> Tornado/Windstorm <input type="checkbox"/> Severe Winter Storm <input type="checkbox"/> Civil Disturbance <input type="checkbox"/> Hailstorm <input type="checkbox"/> Hazardous Material <input type="checkbox"/> Drought <input type="checkbox"/> Earthquake <input type="checkbox"/> Extreme Temperature <input type="checkbox"/> Fire	Ongoing – Inspectors work within own jurisdiction with own forms Proposed Enhancement – Coordinate staff and damage assessment procedures and documentation	Medium	High	All NFIP communities in Marion County	<i>NFIP Coordinator for:</i> Indianapolis Beech Grove Lawrence Southport Speedway	Existing budget
HAZUS-MH Flood Model <ul style="list-style-type: none"> Estimate flood losses and conduct “what if” scenarios using HAZUS-MH Flood Model program. 	<input checked="" type="checkbox"/> Prevention <input type="checkbox"/> Property Protection <input type="checkbox"/> Nat. Res. Protection <input type="checkbox"/> Emergency Services <input type="checkbox"/> Structural Control <input checked="" type="checkbox"/> Public Information	<input checked="" type="checkbox"/> Flooding <input checked="" type="checkbox"/> Dam/Levee Failure <input type="checkbox"/> Tornado/Windstorm <input type="checkbox"/> Severe Winter Storm <input type="checkbox"/> Civil Disturbance <input type="checkbox"/> Hailstorm <input type="checkbox"/> Hazardous Material <input type="checkbox"/> Drought <input type="checkbox"/> Earthquake <input type="checkbox"/> Extreme Temperature <input type="checkbox"/> Fire	Ongoing – GIS staff has received HAZUS-MH training and has the software available to them. Proposed Enhancement – Update HAZUS-MH with local data.	Medium	High	Countywide planning tool also beneficial for preparing benefit-cost ratios for mitigation project grant applications.	Indianapolis GIS	Existing budget FEMA

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT -COST RATIO	PROJECT LOCATION	RESPONSIBLE ENTITY	FUNDING SOURCE
Public Education and Outreach <ul style="list-style-type: none"> Provide hazard awareness literature at public facilities. Continue to participate in Severe Weather Week. Distribute hazard awareness literature at community events. 	<input type="checkbox"/> Prevention <input type="checkbox"/> Property Protection <input type="checkbox"/> Nat. Res. Protection <input type="checkbox"/> Emergency Services <input type="checkbox"/> Structural Control <input checked="" type="checkbox"/> Public Information	<input checked="" type="checkbox"/> Flooding <input checked="" type="checkbox"/> Dam/Levee Failure <input checked="" type="checkbox"/> Tornado/Windstorm <input checked="" type="checkbox"/> Severe Winter Storm <input checked="" type="checkbox"/> Civil Disturbance <input checked="" type="checkbox"/> Hailstorm <input checked="" type="checkbox"/> Hazardous Material <input checked="" type="checkbox"/> Drought <input checked="" type="checkbox"/> Earthquake <input checked="" type="checkbox"/> Extreme Temperature <input checked="" type="checkbox"/> Fire	Ongoing – Variety of hazard related literature already made available and distributed. Proposed Enhancement – Ensure hazard awareness literature is made available at public facilities and community events. Consider targeting programs towards citizens with health problems and living in poverty.	Medium	High	Provide and distribute hazard awareness literature at public facilities and community events. Consider targeting citizens with health problems and living in poverty.	EMD Red Cross	Existing budget FEMA IDNR
Immunization <ul style="list-style-type: none"> Develop and implement a voluntary immunization program for all emergency responders and inspection staff. 	<input type="checkbox"/> Prevention <input type="checkbox"/> Property Protection <input type="checkbox"/> Nat. Res. Protection <input checked="" type="checkbox"/> Emergency Services <input type="checkbox"/> Structural Control <input type="checkbox"/> Public Information	<input checked="" type="checkbox"/> Flooding <input checked="" type="checkbox"/> Dam/Levee Failure <input checked="" type="checkbox"/> Tornado/Windstorm <input checked="" type="checkbox"/> Severe Winter Storm <input checked="" type="checkbox"/> Civil Disturbance <input checked="" type="checkbox"/> Hailstorm <input checked="" type="checkbox"/> Hazardous Material <input checked="" type="checkbox"/> Drought <input checked="" type="checkbox"/> Earthquake <input checked="" type="checkbox"/> Extreme Temperature <input checked="" type="checkbox"/> Fire	Ongoing – Proposed Enhancement – Immunize all emergency responders.	Medium	High	Emergency responders and inspection staff in all NFIP communities.	EMD Health Department <i>Fire and Police Departments for:</i> Indianapolis Beech Grove Lawrence Southport Speedway	CDC
Public Event Coordination and Planning <ul style="list-style-type: none"> Improve planning and coordination among event coordinators, facility owners, and emergency response teams through the Event Advisory Board. 	<input type="checkbox"/> Prevention <input type="checkbox"/> Property Protection <input type="checkbox"/> Nat. Res. Protection <input checked="" type="checkbox"/> Emergency Services <input type="checkbox"/> Structural Control <input type="checkbox"/> Public Information	<input type="checkbox"/> Flooding <input type="checkbox"/> Dam/Levee Failure <input type="checkbox"/> Tornado/Windstorm <input type="checkbox"/> Severe Winter Storm <input checked="" type="checkbox"/> Civil Disturbance <input type="checkbox"/> Hailstorm <input type="checkbox"/> Hazardous Material <input type="checkbox"/> Drought <input type="checkbox"/> Earthquake <input type="checkbox"/> Extreme Temperature <input type="checkbox"/> Fire	Ongoing – Event Advisory Board already in place, and existing coordination and planning efforts are in place. Proposed Enhancement – Improve ongoing planning and coordination efforts.	Medium	High	Countywide	Building owner <i>(private & public)</i> Event Organizer EMD <i>Fire and Police Departments for:</i> Indianapolis Beech Grove Lawrence Southport Speedway	Existing budgets
Hazardous Material Transportation Routes <ul style="list-style-type: none"> Improve enforcement of designated hazardous material transportation routes. 	<input checked="" type="checkbox"/> Prevention <input type="checkbox"/> Property Protection <input type="checkbox"/> Nat. Res. Protection <input checked="" type="checkbox"/> Emergency Services <input type="checkbox"/> Structural Control <input type="checkbox"/> Public Information	<input type="checkbox"/> Flooding <input type="checkbox"/> Dam/Levee Failure <input type="checkbox"/> Tornado/Windstorm <input type="checkbox"/> Severe Winter Storm <input type="checkbox"/> Civil Disturbance <input type="checkbox"/> Hailstorm <input checked="" type="checkbox"/> Hazardous Material <input type="checkbox"/> Drought	Ongoing – Existing ordinance limits hazardous material transportation to I-465, unless load originates and terminates in Marion County. Proposed Enhancement –	Medium	High	Countywide	EMD <i>Police Departments for:</i> Indianapolis Beech Grove Lawrence Southport	Existing budget

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT -COST RATIO	PROJECT LOCATION	RESPONSIBLE ENTITY	FUNDING SOURCE
		<input type="checkbox"/> Earthquake <input type="checkbox"/> Extreme Temperature <input type="checkbox"/> Fire	Improve enforcement of existing ordinance.				Speedway	
Watershed Teams ▪ Re-establish multi-department watershed teams to improve water resource and floodplain planning and coordination.	<input checked="" type="checkbox"/> Prevention <input type="checkbox"/> Property Protection <input type="checkbox"/> Nat. Res. Protection <input type="checkbox"/> Emergency Services <input type="checkbox"/> Structural Control <input type="checkbox"/> Public Information	<input checked="" type="checkbox"/> Flooding <input checked="" type="checkbox"/> Dam/Levee Failure <input type="checkbox"/> Tornado/Windstorm <input type="checkbox"/> Severe Winter Storm <input type="checkbox"/> Civil Disturbance <input type="checkbox"/> Hailstorm <input type="checkbox"/> Hazardous Material <input type="checkbox"/> Drought <input type="checkbox"/> Earthquake <input type="checkbox"/> Extreme Temperature <input type="checkbox"/> Fire	Ongoing – Teams met 1999 through 2001. Proposed Enhancement – Re-establish multi-departmental watershed teams	Medium	Medium	Countywide	SWCD MCHD Indianapolis (DMD, DPW)	Existing budget
Emergency “Go Kits” ▪ Prepare ready made “Go Kits” for emergency response.	<input type="checkbox"/> Prevention <input type="checkbox"/> Property Protection <input type="checkbox"/> Nat. Res. Protection <input checked="" type="checkbox"/> Emergency Services <input type="checkbox"/> Structural Control <input type="checkbox"/> Public Information	<input checked="" type="checkbox"/> Flooding <input checked="" type="checkbox"/> Dam/Levee Failure <input checked="" type="checkbox"/> Tornado/Windstorm <input checked="" type="checkbox"/> Severe Winter Storm <input checked="" type="checkbox"/> Civil Disturbance <input checked="" type="checkbox"/> Hailstorm <input checked="" type="checkbox"/> Hazardous Material <input checked="" type="checkbox"/> Drought <input checked="" type="checkbox"/> Earthquake <input checked="" type="checkbox"/> Extreme Temperature <input checked="" type="checkbox"/> Fire	Ongoing: EMD currently has some “Go Kits” in place. Proposed Enhancement – Ensure adequate supply of “Go-Kits” are available to maximize emergency response services.	Medium	Medium	EOC	EMD MCHD	Existing budget FEMA DHS
Video Monitoring Systems ▪ Purchase and utilize permanent and mobile video monitoring systems to help improve post disturbance prosecution and enhance civil disturbance and crowd control training.	<input type="checkbox"/> Prevention <input type="checkbox"/> Property Protection <input type="checkbox"/> Nat. Res. Protection <input checked="" type="checkbox"/> Emergency Services <input type="checkbox"/> Structural Control <input type="checkbox"/> Public Information	<input type="checkbox"/> Flooding <input type="checkbox"/> Dam/Levee Failure <input type="checkbox"/> Tornado/Windstorm <input type="checkbox"/> Severe Winter Storm <input checked="" type="checkbox"/> Civil Disturbance <input type="checkbox"/> Hailstorm <input type="checkbox"/> Hazardous Material <input type="checkbox"/> Drought <input type="checkbox"/> Earthquake <input type="checkbox"/> Extreme Temperature <input type="checkbox"/> Fire	Ongoing – Permanent video monitoring systems are already in place at Monument Circle. Proposed Enhancement – Purchase and implement permanent and mobile video monitoring systems.	Medium	Medium	Indianapolis Motor Speedway (IMS), Hinkle Fieldhouse, RCA Dome, Circle City Classic, Government Buildings, and other facilities and events throughout the Marion County	Building owner (<i>private & public</i>) EMD <i>Police Departments for:</i> Indianapolis Beech Grove Lawrence Southport Speedway	Existing budget Operational cost FEMA

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT -COST RATIO	PROJECT LOCATION	RESPONSIBLE ENTITY	FUNDING SOURCE
Mobile Data Terminals ▪ Add mobile data terminals to all emergency response vehicles.	<input type="checkbox"/> Prevention <input type="checkbox"/> Property Protection <input type="checkbox"/> Nat. Res. Protection <input checked="" type="checkbox"/> Emergency Services <input type="checkbox"/> Structural Control <input type="checkbox"/> Public Information	<input checked="" type="checkbox"/> Flooding <input checked="" type="checkbox"/> Dam/Levee Failure <input checked="" type="checkbox"/> Tornado/Windstorm <input checked="" type="checkbox"/> Severe Winter Storm <input checked="" type="checkbox"/> Civil Disturbance <input checked="" type="checkbox"/> Hailstorm <input checked="" type="checkbox"/> Hazardous Material <input checked="" type="checkbox"/> Drought <input checked="" type="checkbox"/> Earthquake <input checked="" type="checkbox"/> Extreme Temperature <input checked="" type="checkbox"/> Fire	Ongoing – Already incorporated into police and fire vehicles. Proposed Enhancement - Install in emergency response and critical vehicles.	Medium	Low	Install in emergency response and critical vehicles, especially those operated by Emergency Response Teams, DPW, and Health Department.	EMD Health Department <i>Fire and Police Departments for:</i> Indianapolis Beech Grove Lawrence Southport Speedway	Existing budget DHS
Emergency Water Conservation Ordinance ▪ Incorporate emergency water conservation measures into existing ordinances.	<input checked="" type="checkbox"/> Prevention <input type="checkbox"/> Property Protection <input checked="" type="checkbox"/> Nat. Res. Protection <input type="checkbox"/> Emergency Services <input type="checkbox"/> Structural Control <input type="checkbox"/> Public Information	<input type="checkbox"/> Flooding <input type="checkbox"/> Dam/Levee Failure <input type="checkbox"/> Tornado/Windstorm <input type="checkbox"/> Severe Winter Storm <input type="checkbox"/> Civil Disturbance <input type="checkbox"/> Hailstorm <input type="checkbox"/> Hazardous Material <input checked="" type="checkbox"/> Drought <input type="checkbox"/> Earthquake <input type="checkbox"/> Extreme Temperature <input type="checkbox"/> Fire	Proposed Enhancement – Amend existing local ordinances to incorporate emergency water conservation efforts.	Low	High	Marion County NFIP communities	Water Utilities EMD	Existing budget
Floodplain Development ▪ Update existing Flood Control Ordinance to include compensatory flood storage language for future development in the floodplain.	<input checked="" type="checkbox"/> Prevention <input type="checkbox"/> Property Protection <input checked="" type="checkbox"/> Nat. Res. Protection <input type="checkbox"/> Emergency Services <input type="checkbox"/> Structural Control <input type="checkbox"/> Public Information	<input checked="" type="checkbox"/> Flooding <input checked="" type="checkbox"/> Dam/Levee Failure <input type="checkbox"/> Tornado/Windstorm <input type="checkbox"/> Severe Winter Storm <input type="checkbox"/> Civil Disturbance <input type="checkbox"/> Hailstorm <input type="checkbox"/> Hazardous Material <input type="checkbox"/> Drought <input type="checkbox"/> Earthquake <input type="checkbox"/> Extreme Temperature <input type="checkbox"/> Fire	Ongoing – Proposed Enhancement – Add compensatory flood storage language to existing Flood Control Ordinance.	Low	Medium	Similar to the Flood Control District Ordinance, all NFIP communities in Marion County should adopt and enforce the similar ordinance language.	<i>Planning for:</i> Indianapolis Beech Grove Lawrence Southport Speedway	Existing budget
Unsafe Structure Renovation or Demolition ▪ Develop a process to designate and renovate or demolish unsafe structures	<input checked="" type="checkbox"/> Prevention <input type="checkbox"/> Property Protection <input type="checkbox"/> Nat. Res. Protection <input type="checkbox"/> Emergency Services <input type="checkbox"/> Structural Control <input type="checkbox"/> Public Information	<input type="checkbox"/> Flooding <input type="checkbox"/> Dam/Levee Failure <input type="checkbox"/> Tornado/Windstorm <input type="checkbox"/> Severe Winter Storm <input type="checkbox"/> Civil Disturbance <input type="checkbox"/> Hailstorm <input type="checkbox"/> Hazardous Material <input type="checkbox"/> Drought <input type="checkbox"/> Earthquake <input type="checkbox"/> Extreme Temperature <input checked="" type="checkbox"/> Fire	Proposed Enhancement – Develop a process to designate and demolish an unsafe structure	Low	Medium	Countywide	<i>DMD</i> <i>MCHD</i> <i>Fire Departments for:</i> Indianapolis Beech Grove Lawrence Southport Speedway	Existing budget

5.0**IMPLEMENTATION PLAN**

The following is a proposed plan for implementing all high priority mitigation practices identified in this Plan. It should be noted that implementation of each of these proposed practices may involve several preparatory or intermediary steps. However, to maintain clarity, not all preparatory or intermediary steps are included.

Floodplain Mapping Studies

The floodplains of 112 miles of Approximate Zone A streams have been delineated using approximate methods and not detailed hydraulic analysis. In addition, 16.6 miles of streams have no floodplain designation. As a result, base flood elevations and flood depths are unknown.

- A. Initiate a detailed research regarding additional sources of funding and obtain the required funds to initiate implementation.
- B. Prioritize the remaining unstudied streams in Marion County and establish a timeline to complete the detailed analysis.
- C. Establish a template for these studies and distribute to developers to ensure consistency from reach to reach
- D. Update the 1999 Floodplain Prioritization Study with completed studies, economic loss data, and any changes to prioritization.

Management of Dams – Emergency Action Plans

Failure or misoperation of a high hazard or significant hazard dam could result in social, physical, and economic losses. Emergency Action Plans (EAP) is a very good planning tool to understand and mitigate the impact that a dam failure could have on people and property downstream.

- A. Conduct a detailed study to determine the area downstream of the dam that would be inundated if the dam failed. Identify critical and non-critical facilities downstream and estimate potential damage associated with a dam failure.
- B. Research and compile emergency contact information and flowchart.
- C. Draft detailed training and response procedures.
- D. Prepare a public education and outreach program to alert those that live or work downstream about the potential risk and options to protect themselves and their property.

Management of Levees – Inspection & Maintenance

In order to reduce the physical, social, and economic loss caused by a levee failure, it is necessary to inspect and maintain the levees.

- A. Establish a regular maintenance schedule and ensure staff is trained and available to perform the inspection.
- B. Document deficiencies and ensure these are addressed quickly
- C. Improve the condition of levees documented in the 2003 Levee Inspection Report as in poor or fair condition
- D. Prepare a public education and outreach program for landowner protected by the levee about the potential risk and ways to protect themselves and their property.

Community Rating System (CRS)

The CRS is a voluntary incentive program that recognizes and encourages community floodplain activities that exceed the minimum NFIP requirements. Participation in the CRS program improves floodplain management practices and reduces flood losses and flood insurance premiums.

- A. Review the application requirements and gather supporting documentation including ordinance language, proof of compliance, outreach projects, disclosure forms, repetitive loss information, flood warning program, and approved Flood Hazard Mitigation Plan (Multi-Hazard Mitigation Plan)
- B. Fill out application and calculate total credit points
- C. To expedite the review and approval process, consult with ISO representative to review application before presenting it to the Mayor and submitting it to the NFIP for consideration.

Building Protection

Prohibit construction of new critical facilities in known hazard areas, and protect existing structures in known hazard areas, especially in floodways, through acquisition, relocation, elevation, and floodproofing (non-residential).

- A. Adopt new or amend existing ordinances to prohibit construction of new critical facilities in known hazard areas.
- B. Initiate research on potential funding sources that would provide financial assistance to assist with acquisition, relocation, elevation, and floodproofing of structures in known hazard areas, and secure appropriate funding.
- C. Identify and prioritize a list of structures for acquisition, relocation, elevation, and floodproofing, and focus on structures within floodways.

Flood Protection Studies

Flood protection studies are essential to identify and understand the area and extent of damage as well as a range of solutions to mitigate the flooding problem. While planning is an important exercise, implementation is critical to mitigating flooding problems and reducing social, physical, and economic losses in Marion County.

- A. Evaluate and prioritize the recommendations in the existing flood protection studies – especially in those neighborhoods with repetitive flood losses (Union Chapel, Beach Avenue, 77th Street, Ravenswood, Frog Hollow, and High Acre Manor).
- B. Prepare detailed benefit-cost analyses for the high priority projects as funding becomes available.
- C. Apply for flood mitigation project funds from FEMA (Pre-Disaster Mitigation, Flood Mitigation Assistance, or Hazard Mitigation Grant Program).

Emergency Warning Systems

Improve outdoor warning siren coverage to alert the local population of tornados and windstorms.

- A. Identify all relevant critical facilities and densely populated areas not covered by outdoor warning systems, and prioritize those uncovered areas for future outdoor warning system coverage.

Community Emergency Response Team (CERT)

Establish a Marion County CERT in order to educate people about disaster preparedness and improve emergency response at the local level.

- A. Utilize the risk assessment information conducted for this Plan to assist with determining relative priorities for the Marion County CERT, and to assist with determining how the Marion County CERT can be of greatest benefit to emergency response in Marion County.
- B. Identify overall CERT needs related to personnel, equipment, training, materials, and funding.
- C. Initiate research regarding sources of funding available to establish and maintain an effective CERT and obtain the necessary funding to initiate the program.
- D. Develop a public information campaign to increase the public's awareness, interest, and understanding of the CERT, and to ensure that all relevant stakeholder groups have been targeted for participation.
- E. Acquire local CERT training materials from FEMA, tweak training materials to local needs, establish a final training program, and implement CERT training.

Safe Havens & Community Shelters

Require tornado shelters in new and existing mobile home parks, establish safe havens and community shelters in vulnerable locations, require safe rooms in all new public facilities, and clearly advertise the location of safe havens and community shelters.

- A. Identify all existing mobile home parks in Marion County.
- B. Adopt new or amend existing ordinances to require tornado shelters in all new and existing mobile home parks.
- C. Initiate research on potential funding sources that would provide financial assistance for developing tornado shelters in existing mobile home parks and obtain necessary funding.
- D. Adopt new or amend existing ordinances to require safe rooms in all new public facilities.
- E. Inventory and prioritize local communities and neighborhoods that would benefit most from additional shelters or safe havens.
- F. Develop a public information campaign, which clearly identifies local shelters and safe havens and builds public support for new requirements. Coordinate with Neighborhood Liaisons, Homeowners Associations, Churches, and other community groups to maximize local support and buy-in.

Power Back-up Generators

Require power back-up generators in all critical facilities and lift stations, secure a fuel reserve to ensure that critical facilities can run on power back-up generators for extended periods, and designate I-70 as a fuel reserve transportation route.

- A. Identify all critical facilities and lift stations that do not have power back-up generators.
- B. Adopt new or amend existing ordinances to require power back-up generators in all critical facilities and lift stations.
- C. Initiate research regarding potential funding sources that would provide financial assistance for purchasing and implementing power back-up generators in critical facilities.
- D. Develop a mailing list inclusive of all relevant critical facilities in Marion County, informing them of the new requirements. Include an informational brochure in the mailing that

discusses important details on power back-up generators such as benefits, costs, and various purchasing information.

Municipal Snowplow GPS

Add GPS Units to all municipally owned and operated snowplows, in order to track the location of snowplows for safety of DPW and Street Department staff and to efficiently monitor areas plowed.

- A. Inventory existing municipal snow plow fleets to determine overall need and prioritize vehicles for initial implementation.
- B. Initiate research regarding sources of funding available to purchase GPS Units for snowplows and obtain necessary funding.
- C. Purchase and begin installing GPS Units.

6.0**PLAN MAINTENANCE PROCEDURES****6.1 MAINTENANCE PROCESS**

Throughout the 5-year planning cycle, the Marion County EMD will reconvene the MHMP Planning Committee on an annual basis in order to monitor, evaluate, and update the Plan as needed. Members of the Planning Committee are readily available to engage in meetings between annual meetings. Depending on grant opportunities and fiscal resources, mitigation projects may be implemented independently by individual NFIP communities or through local partnerships.

This is the first MHMP that Marion County NFIP communities have prepared. The data used to prepare the Marion County MHMP was based on “best available data” or data that was readily available during the development of this Plan. Because of this, there are limitations to the data. As better data becomes available, updates should be made to the risk assessment and vulnerability analysis.

Updates or modifications to the Marion County MHMP during the 5-year planning process will require a public notice and/or meeting prior to submitting revisions to the individual jurisdictions for approval.

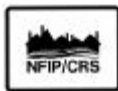
6.2 INCORPORATION INTO EXISTING PLANS

Many of the mitigation projects identified as part of this planning process are on going with some enhancement needed. Where needed, modifications will be made to NFIP communities’ planning documents and ordinances during the regularly scheduled update. Local planning documents and ordinances may include comprehensive plans, floodplain management plans, capital improvement plans, zoning ordinances, building codes, site development regulations, or permits.

6.3 CONTINUED PUBLIC INVOLVEMENT

Continued public involvement is critical to the successful implementation of the Marion County MHMP. Comments from the public on the MHMP will be received by the EMD Director and forwarded onto the MHMP Planning Committee for discussion. Education efforts for hazard mitigation will be the focus of the annual Severe Weather Awareness Week as well as incorporated into existing stormwater planning, land use planning, and special projects/studies efforts. Once adopted, a copy of this Plan will be available for the public to review at the Marion County EMD Office.

Updates or modifications to the Marion County MHMP during the 5-year planning process will require a public notice and/or meeting prior to submitting revisions to the individual jurisdictions for approval.



The CRS program credits NFIP communities a maximum of 37 points for adopting the Plan; establishing a procedure for implementation, review, and updating the Plan; and submitting an annual evaluation report.

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